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**EXPLORING THE BALANCE:  
A PATH ANALYSIS EXAMINATION OF THE MAINTAINING THE BALANCE  
MODEL**

A Dissertation Presented

by

SHEILA D. PENNELL

Submitted to the Graduate School of the  
University of Massachusetts Amherst in partial fulfillment  
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2017

College of Nursing

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Approved as to style and content by:

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Cynthia Jacelon, Chair

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Jeungok Choi, Member

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Rebecca Ready, Member

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Steven Cavanaugh, Dean  
College of Nursing

## **DEDICATION**

I would like to dedicate this dissertation to my wonderful family. To my partner, Abel who supported, cooked, and cleaned for me while I worked full time and completed graduate school. To my parents, Dorene and Wendell, who supported me in every way as I pursued my higher education. To my sister, Molly for commiserating with me about nursing school and providing comic relief throughout my experience as a graduate student. And to my grandparents, Edwin, Betty, Irene and John who believed in me, cared for me, and inspired my desire to help older adults age successfully at home. I couldn't have done any of this without all of their support and encouragement.

## **ACKNOWLEDGMENTS**

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## **ABSTRACT**

### **EXPLORING THE BALANCE: A PATH ANALYSIS EXAMINATION OF THE MAINTAINING THE BALANCE MODEL**

**MAY 2017**

**SHEILA D. PENNELL, BS, UNIVERSITY OF MASSACHUSETTS AMHERST**

**Ph.D., UNIVERSITY OF MASSACHUSETTS AMHERST**

**Directed by: Professor Cynthia Jacelon PhD**

Home is the desired site of care for most adults in the US (Eckert, Morgan & Swamy, 2004). The number of older adults who potentially require supportive care at home is rapidly growing. Our current healthcare infrastructure must evolve to accommodate the preference for homecare. This investigation will provide quantitative testing of a qualitatively-derived model called Maintaining the Balance (MTB) developed by Jacelon (2010). MTB describes the factors that drive a community-dwelling older adult's ability to achieve OW in the home environment. Secondary analysis of data collected for the National Social Life, Health, and Aging Project (NSHAP) was utilized. Path analysis technique was employed to explore the effect of the 5 balance variables: health, activity, autonomy, attitude, and relationships on the outcome variable of OW. Attitude was the variable with the largest effect on OW. Activity, health, and relationships also had significant effects on OW. Autonomy and age were non-significant factors. The hypothesized model was partially supported by the NSHAP dataset.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background and Significance

Home is the desired site of care for most adults in the United States (Eckert, Morgan & Swamy, 2004). How older adults balance the myriad factors that contribute to their optimal wellness (OW), allowing them to remain successful at home, is complex and not well understood. Disruptions to any aspect of an older adults' life could result in hospitalization, institutionalization, or death.

The number of older adults in the United States is expected to reach 19% of the total US population by 2030 (Administration on Aging, 2014). Chronic disease is prevalent in half of the adult population of the United States, with one in four adults suffering two or more chronic health problems (CDC.gov). The Institute of Medicine cautions that our current healthcare infrastructure is inadequate to meet the needs of this growing demographic group. In the 2008 report *The Retooling for an Aging America, Building the Health Care Workforce* the IOM urges researchers to develop models that address health promotion and illness prevention. The Maintaining the Balance (MTB) model addresses the older adult in a holistic manner, seeking to understand the fundamentals of successful community-based living. A first step in improving care models for effective wellness promotion is to build our understanding of what facilitates success, especially for the vulnerable population of older adults with chronic health problems.

## **1.2 Purpose**

The purpose of this investigation was to examine the qualitatively derived model of MTB developed by Jacelon (2010) to determine its usefulness for describing a community-dwelling older adult's ability to achieve OW in the home environment. This model shows promise for refinement into a mid-range theory. A first step toward this theory creation is path analysis of the model. The community-dwelling older adult participant's words captured in this model have the potential to explain some of the intricate complexity of what it takes to be independent and well in the community. The use of a large dataset of community dwelling older adults to test the elements of this qualitatively derived model is an opportunity to validate, revise, and refine this model so that it can guide community based nursing actions and further research.

## **1.3 Aim**

The overall goal of the study was to discover if the MTB model is supported by the NSHAP dataset and to revise the model based on the findings from an initial path analysis. The specific research questions answered address the direct, mediating, and moderating effects among the variables.

## **1.4 Primary Research Questions**

Direct Effects:

1. What is the direct effect of each balance variable on OW?

Indirect (Mediating) Effects:

2. Does activity mediate the effect of attitude on OW?

3. Does activity mediate the effect of relationships on OW?
4. Does health mediate the effect of activity on OW?

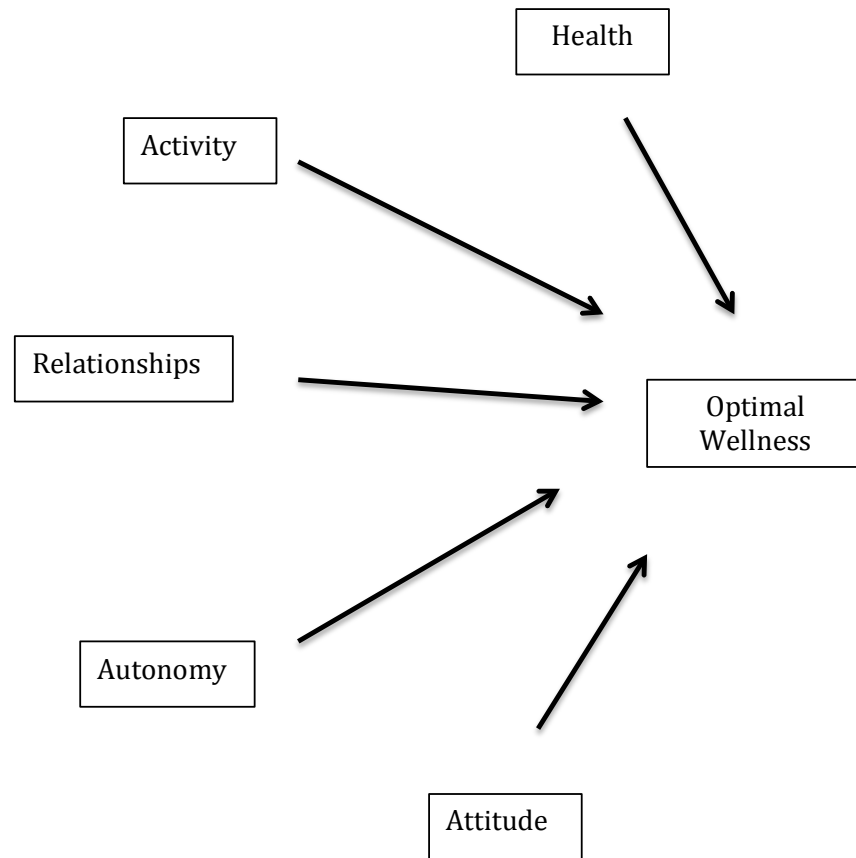
Moderating Effect:

5. Is age a moderating variable of the relationship between health and OW?

### **1.5 Theoretical Framework: MTB**

MTB is a qualitatively derived model developed by Jacelon (2010). Jacelon undertook a qualitative descriptive study using a symbolic interaction approach with ten older adults aged 75-98 years with at least one chronic health problem. The research goal was to understand the actions and ascribed meanings that older adults had to living daily with their chronic health problem(s) (p.17). The overall theme of “maintaining the balance” was made up of the five sub-themes activity, attitude, autonomy, health, and relationships. When the five sub-themes are in balance, the older adult is able to achieve OW.





*Figure 1.* Jacelon (2010)’s original conceptualization of MTB.

### **1.6 National Social Life, Health, and Aging Project (NSHAP) Database**

The National Social Life, Health, and Aging Project (NSHAP) is a longitudinal population based study designed and conducted by an interdisciplinary group of researchers also at the University of Chicago. Two waves of data are currently available Wave 1 (2005-2006) n=3,005 and Wave 2 (2010-2011) n=3,337 (NORC), and a third wave is in progress. The sample is a complex, multistage area probability sample of community dwelling individuals born between 1920 and 1947 with oversampling of Hispanic and African American individuals (ICSPR, para 8). The National Social Life, Health, and Aging Project is supported by the National Institutes of Health, including the

National Institute on Aging, the Office of Women’s Health Research, the Office of AIDS Research, and the Office of Behavioral and Social Sciences Research (R01AG021487). The data was readily available to this researcher to utilize for secondary analysis. Chapter 3 provides detailed information about database, congruence with this investigation, and quality evaluation.

### 1.7 Definition of Terms

Independent and dependent variables for this study were informed by the theoretical model MTB, derived from the words of older adults living with chronic health problems in the community. Literature review helped to refine and guide the operational definitions for each variable, and chosen operational definitions expanded the literature review search. The description of relationship between model concept, variable, and definition are summarized in Table 1.

Table 1  
*Concepts and Definitions*

<u>Model Concept</u>	<u>Variable</u>	<u>Definition</u>
<i>Demographics</i>	Age	Subject’s Age
	Gender	Subject’s Gender
	Education Level	Subject’s Education Level
	Race	Subject’s Race
	Marital Status	Subject’s Marital Status
<i>Independent Variables</i>		
Health	Number of Chronic Health Problems	Subject’s report of presence of 15 possible health conditions
Activity	Ambulatory Ability	Subject’s score in seconds on Get Up and GO test
	ADL Dependence	Subject’s report of ability to complete 5 ADL tasks
Autonomy	Sense of Control	Subject’s report on “I feel

Attitude	Happiness	unable to control important things in my life” Subject’s report of overall happiness level
	Things are going my way	Subject’s response to frequency of feeling things are going my way
Relationships	Social Contact Frequency	Subject’s report of contact frequency with friends or relatives
<i>Dependent Variable</i> Optimal Wellness	Self-Rated Physical Health	Subject’s report of physical health status
	Self-Rated Mental Health	Subject’s report of physical health status
	Relative to Peer Health Status	Subject’s report of relative to peer health status

**1.7.1 Demographic Variables.** Demographic variables relevant to this investigation include age, gender, household income, education level, and race.

**1.7.2 Independent “Balance” Variables.** The independent variables measured for this study include the five balance variables identified in the MTB model: health, activity, autonomy, attitude, and relationships.

**1.7.2.1 Health.** Health is commonly defined as an absence of disease. In the context of the MTB model, health is conceptualized as the absence of disease burden. In the context of the model, health is the spectrum from severe illness to lack of illness that an older adult must balance with the other variables to achieve OW.

In this investigation, health was measured in terms of the number of chronic health conditions an individual self-identifies. The NSHAP database asks respondents to respond yes or no to whether a healthcare practitioner has ever told them they have any of the list of 15 possible health conditions. The health conditions include arthritis, ulcers, COPD, asthma, stroke, diabetes, dementia, cirrhosis, leukemia, lymphoma, skin cancer,

other cancer, poor kidney function, thyroid condition, and prostate enlargement. The number of conditions identified as “yes” by each individual were tallied into a single variable reflecting total number of conditions, of the possible 15.

**1.7.2.2 Activity.** The Merriam-Webster dictionary defines activity as “vigorous or energetic action” or “liveliness.” Being active and maintaining a high level of physical activity is commonly touted as the most important factor for obtaining and maintaining wellness. In MTB, activity is more specifically described as the ability to get around and complete needed daily activities independently.

Two measures of activity were available in the NSHAP database, timed scores on the “Get up and Go” test and self-reported difficulty scores for completing ADL activities. For the “Get up and Go” (GUG) test, researchers recorded how long it took the participant to stand from a chair, walk 10 feet, and return to sit in the chair. These scores in seconds were combined to create a GUG variable. Additionally, 0-3 ratings indicating “0” no difficulty to “3” unable to do are available for five ADL tasks: dressing, bathing, eating, transferring, and toileting. These scores were tallied into a single ADL Difficulty variable where a higher value represents a higher level of difficulty. A composite variable of Activity was derived from the ADL Difficulty and GUG variables by standardizing them with a Z-score and computing them together into one Activity variable.

**1.7.2.3 Autonomy.** Autonomy is feeling in control and independent. In the field of nursing, students are taught that respecting a patient or client’s autonomy is an essential part of ethical practice. In MTB, autonomy is conceptualized personally for the individual as feeling in control of life decisions.

Autonomy was not a variable of interest for the original NSHAP database inquiry, however, within the depression scale used there is a single item that asks participants to rate if they felt “unable to control important things in my life.” This single variable was utilized to represent autonomy in this investigation.

**1.7.2.4 Attitude.** The common adage “attitude is everything” can be found on everything from inspirational coffee mugs to self help books (i.e Keller, 2012). Attitude was conceptualized in MTB as the general positive or negative outlook of an older adult toward the their circumstances.

Two clear measures of attitude were selected from the NSHAP database to capture the older adult participant’s attitude: “on the whole” self-rated happiness scored from “1” usually unhappy to “5” extremely happy; and “in the past week I felt things were going my way” scored from “1” rarely or none of the time, to “4” most of the time. Overall happiness reflects the disposition of the individual, and the “felt things were going my way” variable reflects a positive or negative outlook in the immediate past. A composite variable was created to capture both elements into the single variable of Attitude.

**1.7.2.5 Relationships.** As social beings, our relationships are very important in our daily lives. For older adults in the community, many types of relationships work together to provide help, support, and social interaction. In MTB, relationships are the social interactions with family, friends, pets, and neighbors that an older adult experiences on varying levels of intimacy.

In the NSHAP database, relationships is operationalized with a measure of frequency of socializing with friends or relatives in the last year. Social frequency is scored from “0” representing never to “6” representing several times per week.

**1.7.3 Dependent “Outcome” Variable.** The dependent variable of OW derived from the MTB model was used for this study.

**1.7.3.1 OW.** Self-rated physical and mental health (SRH) in combination with relative to peer health status was the outcome measure for OW. In this conceptualization, “optimal wellness” was the individual’s global perception of physical and mental health, reflecting their human experience of, presumably, all the balance variables acting together to create the experience of high or low OW.

The NSHAP database provides a 5 point likert-scale with “1” reflecting poor health and “5” reflecting excellent health for each physical and mental. It also provides a variable for health status relative to age peers, asking individuals to compare their health with other person’s their age from “1” indicating much worse, to “5” indicating much better. These three variables were standardized and combined to create the variable of OW.

## **1.8 Summary**

This study adds to the body of knowledge surrounding how older adults with chronic health problems manage and maintain their wellness in the home environment. MTB shows promise, after refinement, for use in designing nursing intervention or home-based models of care that are derived from qualitative and quantitative data from community dwelling older adults in the US. The variables of interest in the MTB model

were health, activity, autonomy, attitude, and relationships. The impact of these independent variables on the outcome variable of OW was explored via a path analysis approach in this investigation. The relationships between and among the variables were painted with broad strokes in Jacelon's original (2010) work. No causality, variable interrelationships or directions are explicated in this initial model. So, in order to move forward with quantitative testing of MTB via path analysis technique, literature review was performed to explore variable inter-relationships and develop a path diagram that could be tested. Chapter 2 reports on the review of the literature that was conducted to design the path diagram of the MTB model. Jacelon's (2010) findings, in combination with this review of the literature, form the basis of the hypothesized MTB model. Chapter 3 details procedure utilized to complete the path analysis and test the hypothesized MTB model. Chapters 4 and 5 present results and discussion of findings from this investigation.

## **CHAPTER 2**

### **REVIEW OF THE LITERATURE**

#### **2.1 Introduction**

This chapter addresses the existing research that relates to the relationships among variables in the MTB model. The literature review will first address the 5 balance and single outcome variable together, and then address each balance variable in relation to the outcome variable. Relationships and interactions identified among the balance variables are discussed.

#### **2.2 Search Strategy**

Search of CINAHL, Psych Info, Academic Search Premier, and PubMed databases were undertaken. Snowball sampling expanded the search significantly. Searches were expanded as additional related search terms were identified. Discrepancies and gaps in the literature that were addressed in the scope of this investigation are discussed.

The outcome variable of OW in this study is the individual's global perception of physical and mental health, reflecting their human experience of, presumably, all the balance variables acting together to create the experience of high or low OW. OW is not a commonly used term in previous research. Therefore, to capture previous variable interactions in a literature review the operational definition of "self-rated health" (SRH) is used as a search term. Operational definitions of the balance variables (discussed in CH



1) were also used as related search terms to help capture the essence of the concepts as they are operationally defined in this investigation.

### **2.3 Evidence Related to MTB Model**

OW, health, activity, autonomy, attitude, and relationships were queried together in each possible combination to locate articles that incorporate the 5 balance and outcome variables together.

Jacelon (2010) is unique in its application of the 5 balance variables to explain OW for older adults. No other research identified has utilized these 6 variables or their operational definitions together. Four of the variables of interest: OW, activity, health, and attitude are found together in a study by Malmusi, Aratazcoz, Benach, & Borrell (2012). The authors examined the gender disparity in SRH (OW) to discover the underlying mechanism for gender differences using a cross-sectional regression analysis. A large sample size lends strength but is focused on a Spain-only sample, limiting generalizability. The significant effect of gender disappeared in the regression when controlling for number of disease conditions. They concluded that the poorer SRH of women was a result of higher disease burden. These findings, while interesting, are not closely related to the MTB model.

Jin-Kyoung, Soon-Lae, Do-Young & A-ri (2014) used these same four variables of interest: outcome variable OW, and balance variables activity, health and attitude in their investigation with Korean older adults (age 65+). The investigation includes a partial measure of relationships by using living alone as a demographic variable. This study is more closely related to the current investigation in that the research goals

included identifying the effect of health, attitude, activity and a partial measure of relationships on total OW as SRH. The authors propose that an older adult has multiple “dimensions” of function (medical, functional, and self-evaluative) that interconnect to create “perceived” health status. However, they do not provide a theoretical base to contextualize the interconnection. Using multiple regression analysis, the authors conclude that individuals with diabetes mellitus, arthritis, dyslipidemia, MI or angina, stroke (poorer health) or depression (negative attitude) had lower SRH than those without these diagnoses. Older adults with limitations to their activity (poorer activity) also showed significantly lower SRH than those without activity limitation. This investigation does not have a robust measure for relationships, but there was a secondary finding that older adults who lived alone had lower SRH. The mathematical logic for analyses chosen are not described in this study. Because this study is not theoretically grounded or based from a verbalized theoretical model, it is difficult to see the full context of the dimensional interaction mentioned at the outset.

Existing research utilizing the 5 balance variables and OW is extremely limited. The MTB model is unique in the application of these variables together. The remainder of this chapter will discuss the existing literature related to each variable individually, and for the 5 balance variables will discuss the relationship of that variable to OW as it exists in the literature. Significant relationships among balance variables are also discussed where identified.

## **2.4 Evidence related to OW**

In the MTB model, OW is the descriptor used for the human experience of an individual's total mental and physical wellbeing. It is the state in which all of the many variables of daily life are in a pleasant homeostasis. OW in this investigation is operationally defined using SRH. This measure captures the global nature of the concept. SRH is "considered a subjective measurement integrating the biological, mental, social, and functional aspects of an individual (Ocampo, 2010, p.275)."

OW as SRH is commonly accepted as an accurate and sensitive measure of the global state of health, psychological wellbeing, and quality of life (Ocampo, 2010). Many factors have been previously studied in relation to SRH. Higher education level and higher income are consistently associated with higher SRH (Alves et al., 2005; Elwell-Sutton et al, 2011; Barros, Zanchetta, Moura, & Malta, 2009). Age and gender have shown mixed relationships with SRH (Barros, Zanchetta, Moura, & Malta, 2009; Wolinsky et al, 2008), as well as race (Boyington, Howard & Holmes, 2008). Self-efficacy (Nutzal et al, 2014) and positive affect (Segerstrom, 1993) have also been found to have positive correlations with SRH, while negative affect (Segerstrom, 1993) and chronic pain (Rosso, Gallagher, Luborsky & Mossey, 2008) are associated with lower SRH. Functional capacity (Alves et al., 2005) may also be related to SRH. However, even older adults who report high presence of chronic disease or long-term disability may report good or excellent SRH (Badley, Yoshida, & Webster, 1993). A similar finding was mentioned in the findings from Alpass & Neville (2003) where SRH was related to depression but diagnosis of a chronic condition was not. These findings suggest that persons with chronic conditions may still feel relatively healthy, but the mechanism is not

understood. Alpass & Neville's sample was limited by including only males from a single regional area of New Zealand. However, the contradiction of older adults with significant chronic disease or long term disability reporting positive or non-decreased SRH across studies provides support conceptually for the MTB model. There are many other factors at play in an older adult's perception of OW in addition to just the variable of health.

OW captures a global perception of an individual's health as they perceive it. Many important individual characteristics have been studied in relation to OW. The perception of health is not always directly related to objective measures of disease burden or activity level, and chronically ill or disabled individuals may still perceive their wellness as optimal. The factors that contribute to this contradiction are of particular interest for supporting wellness in the presence of chronic illness. This contradiction may be explained by the combination of variables described by the MTB model.

## **2.5 Evidence Related to Health**

Chronic disease has become the leading cause of death in the United States. The Centers for Disease Control (CDC) report that as of 2012, one in four adults had two or more chronic health problems. The economic cost of dealing with chronic disease is enormous, with 86% of all healthcare spending in 2010 for people with one or more chronic conditions. Three in four Americans over age 65 have multiple chronic conditions that require ongoing attention and assistance with daily tasks. The presence of chronic disease(s) in an individual is a significant impairment of health, and is the measure of health used for this investigation.

**2.5.1 Health in Relation to OW.** The balance variable health is measured by chronic disease burden and is significantly associated with OW as SRH in the literature. Increased chronic disease presence is consistently correlated with poorer SRH (Berglund, Lytsy & Westerling, 2014; Galenkemp, Braam, Huisman, & Deeg, 2013; Segerstrom, 2014). OW as SRH is also consistently correlated with mortality in nearly all studies (Idler & Benyamini, 1997). However, in some studies older adults with chronic disease or long-term disability may report good or excellent SRH (OW) (Badley, Yoshida, & Webster, 1993).

The number of chronic diseases has been found to be associated with SRH (OW) with higher number of diseases corresponding with lower SRH (OW) (Hoeymans, Feskens, Kromhout, & van de Bos, 1999; Pinguart, 2001; Jonnalagadda & Diwan, 2005). In one examination, medical comorbidity (presence of multiple chronic diseases) explained 11.7% of the variance in SRH (OW) and this effect was found to be largely direct and not mediated by their other physical and mental health domains (Perruccio, Katz & Losina, 2012).

Several of these studies were limited by their sample populations which were focused in a relatively small geographic areas (Hoeymans, Feskens, Kromhout & van de Bos, 1999; Galenkamp, Braam, Huisman, & Deeg, 2013) or on specific sub-population groups (Jonnalagadda & Diwan, 2005; Perruccio, Katz & Losina, 2012) and one was constrained by the selection criteria for the original dataset that were not relevant in the secondary analysis (Segerstrom, 2014). However, the findings are consistent across these focused sub-groups.

In a detailed examination of the effect of number of chronic diseases on SRH (OW), Galenkamp, Braam, Huisman & Deeg (2011), used data from LASA (Longitudinal Aging Study Amsterdam) to determine the effect of number of diseases on SRH (OW) across age cohorts. The stratified random sample is strongly representative of the Netherlands population. The regression analysis accounted for the ordinal nature of SRH data and the violation of parallel lines assumption where applicable. Their findings indicate a more complex non-linear association between the constructs for all but the oldest-old age group. Their findings “indicate that the impact on SRH decreases with each increment in number of diseases (p.383).” This non-linear relationship reflects a relatively large impact of having a single disease compared with co-morbid conditions. This relationship was true controlling for confounding effects of income, education, marital status, gender and age in years. Age cohort group, however, did show a significant difference within the oldest old category, defined as 85yrs+, with this group reflecting a linear relationship and cumulative impact of additional chronic disease burden. Also uniquely in this group having no disease was also not significantly different than having one disease. The authors suggest that this may be because this age group has a higher prevalence of poor SRH (OW) even in individuals without chronic disease. The lower response rate in the youngest age cohort category may have affected the results by skewing toward healthier younger individuals. For all but the oldest-old age group, having a single disease increased the chance of having poorer SRH to a larger extent than did each subsequent comorbid condition.

An individual experiencing one or more chronic diseases is likely to rate their health lower overall than an individual who is not. In an examination of older men in the

Netherlands, the chronic disease most likely to be associated with poor SRH was stroke. Respiratory symptoms, heart disease, diabetes, and musculoskeletal complaints were also significantly related to poor SRH, while cancer and back pain were not (Hoeymans, Feskens, Kromhout, & van de Bos, 1999). In a Canadian total population sample (age 12+), fibromyalgia and chronic pain syndrome as well as cancer were strongly associated with poor or fair SRH, stroke and heart disease were also significantly associated with poorer SRH but to a lesser extent. In contrast, an examination of individuals age 65-85 with multimorbidity in Germany, Nutzel et al. (2014) found that it was not the presence of any specific chronic disease that predicted SRH changes. Instead pain, activity limitations, and depression were far more strongly associated with SRH. Mantyselka, Turunen, Ahonen & Kumpusalo, (2003) corroborate that chronic pain is a strong independent predictor of low SRH. The literature reflects mixed results across samples regarding which chronic diseases, if any, have a significant impact on SRH. Some of the inconsistency may be due to the focused sub-groups that make up the sample for many of the investigations.

The association between OW (SRH) and Health (chronic disease state) trends toward higher chronic disease state predicting poorer SRH (OW) in existing literature. The moderating effect of age on the relationship between Health and OW suggested by Galenkamp, Braam, Huisman & Deeg (2011) was tested for in this investigation.

## **2.6 Evidence Related to Activity**

Activity is well-established as an important component of overall wellness. Across age and demographic groups, activity is consistently positively correlated with

higher measures of health and wellness. High levels of physical activity correlate with better cardiovascular health outcomes (Myers et al., 2015; Paffenbarger, Wing, & Hyde, 1978). Across multiple studies, higher levels of physical activity also correlate with self-rated physical (Cimarras-Otal et al., 2014; Eifert, Wideman, Oberlin & Labban, 2014; Hansen, Beyer, Flensburg-Madsen, Gronbaek & Helge, 2013; Teri et al, 2011) and mental (Meyer, Castro-Schilo & Aguilar-Gaxiola, 2014; Engberg et al., 2015) health, the key components of OW.

From ancient historical texts to modern recommendations from the American Heart Association and the Surgeon General, physical activity and its link to health and wellness are undisputed. In ancient China and India as many as 5.000 years ago the benefits of physical activity are touted in texts such as the *Ayur Veda* and early Taoist and yoga teachings. In Greece in the 5<sup>th</sup> Century BC, Herodiscus prescribed therapeutic exercise regimens and Hippocrates wrote extensively about the preventative power of exercise for physical and mental ailments. In the 1700's AD the Italian physician Ramazzini identified the negative health consequences of sedentary occupations when compared with more physically active running messengers (Bouchard, Blair, & Haskell, 2012).

With the advent of modern investigative science in the disciplines of epidemiology and exercise science, statistical rigor was applied to historically held beliefs about the link between activity and health. Paffenbarger, Wing, & Hyde (1978) are credited by Bouchard, Blair, & Haskell eds. (2012) with publishing the first quantitative results for the relationship between high levels of physical activity and decreased risk for heart attack in male college alumni. Paffenbarger & Lee (1998) report



on continued results from the College Alumni Health Study: during the 16 year follow-up, men who were moderately to vigorously physically active gained 1.5 years of life by age 90 compared with less active men. The proportions of men playing moderate or vigorous sports declined with age, while engagement in light sport activity increased with age. Most protective was engagement in moderate sports play, resulting in a 27% reduced mortality risk overall. The presence of smoking, hypertension, chronic disease, and BMI are considered as confounding factors, but moderate levels of exercise remain protective for mortality. Myers et al. (2015) state that since these historically important studies, “evidence has accumulated from occupational, leisure time, and PF [physical fitness] assessment studies that support a strong, inverse, graded and independent association between PA, health and both CVD and overall mortality (p.308).” The evidence for the benefits of physical activity are so strong that in 1996, the US Surgeon General’s office released a report touting the benefits of moderate physical activity including improved health, quality of life, mental health, and the health of bones, muscles and joints as well as a reduction in mortality, coronary heart disease, hypertension, colon cancer and diabetes (US Department of Health and Human Services, 1996). While a significant weakness in nearly all of the early studies concerning physical activity was that they were all conducted exclusively with college-graduate male participants, subsequent research has affirmed similar health benefits for other demographic groups.

For older adults, the physical activities that are most important in daily life include the ability to get up and around, and complete the daily tasks needed to maintain themselves and their environment. In the MTB model, activity is defined as a “Get up and Go” (GUG) test score (in seconds) and the number of ADLs with which an older

adult has difficulty. Poor self rated health has been found to be an independent predictor of poor timed up and go score in older community dwelling women (Idland, Rydwik, Smastuen & Bergland, 2013), however this relationship is not well researched. Difficulty with ADL tasks is correlated with poorer SRH across community-dwelling older adult populations (Idland, Smastuen, Engedal, & Bergland, 2014; Ng, Niti, Chiam, & Kua, 2006), however the context of this correlation is not well studied.

Idland, Smastuen, Engedal & Bergland (2014) undertook a longitudinal investigation with a small Norwegian sample utilizing 3 time points in 2007, 2009, and 2011. Utilizing logistic regression models, Timed up and Go (TUG) score at baseline and MMSE score at baseline were the independent variables associated with remaining non-disabled at time point 3. Self rated health was simplified by these researchers into 3 categories: good, fair and poor and was found to decrease significantly from time point 1 to time point 2 but not from time 2 to time 3 in spite of continued significant decreases in TUG and MMSE score. The presence of a large selection bias in their sample, and very limited statistical power limits the generalizability of these findings. The current investigation will further examine the relationship of ADL difficulty and GUG score in the context of the MTB model.

## **2.7 Evidence Related to Autonomy**

Autonomy is regarded as highly important to the provision of nursing and medical care. In Ancient Greece, patient participation in medical decision-making was considered undesirable. Obedience to physician authority continued throughout much of human history. English Common Law formed the basis for a systematic shift away from

deception and toward informed consent in medical practice. Consent gained popularity and was upheld in US courts throughout the beginning of the 20<sup>th</sup> century (Murray, 1990). This shift is mirrored by an overall cultural evolution in the Western world toward individual self-determination. The value of autonomy stems from the common cultural belief that each individual has a right to determine for herself what is best, and it is closely linked to the concept of competence which is generally presumed to be necessary for autonomous decision making. Patient-centered care in the field of nursing focuses on providing each person individualized care that supports autonomy and dignity (Davies, Laker & Ellis, 1997).

Research focused on autonomy and the closely related concepts of perceived control and mastery remains sparse in relation to the health of older adult individuals. Autonomy is not well-defined, or well-researched and many partially synonymous concepts hint at its presence. For this review, autonomy, sense of control, perceived control, and mastery were included in relation to SRH to obtain an adequate number of articles for review.

Feeling in control of life circumstances is hypothesized to be protective against stress, leading to improved physical and psychological health. Cott, Gignac & Badley (1999) sought to differentiate the determinates of SRH for a chronically ill or disabled Canadian sample. In their investigation, feeling in control (mastery) was significantly correlated with SRH only in the portion of the sample that reported chronic conditions or disability. The subset of the sample that was non-disabled and non-chronically ill did not show an association between SRH and mastery. Psychological resources, especially

mastery and self-esteem are associated with better SRH for individuals with chronic conditions or disability (Cott, Gignac, & Badley, 1999).

Sense of control also has a significant relationship to psychological health. In a 1990 correlational study seeking to identify predictors of psychological well-being for nursing home older adults, Bowsher & Gerlach surveyed 302 cognitively intact nursing home residents with mean age of 79. This convenience sample was comprised almost entirely of widowed white women. Findings included that feeling autonomous “in control” explained a significant portion, 19%, of the variance in psychological well-being. The authors conclude that this finding supports the proposition that personal control is related to psychological well-being.

In an examination of younger-old community dwelling French older adults, Wahrendorf, Ribet, Zins and Siegrist (2007) looked for the relationship between three activities thought to represent varying levels of control, a few likert scale items reflecting sense of control, and depressive symptoms. Findings included that voluntary work (thought to show higher autonomy) was associated with lower depressive symptoms, and caregiving (low autonomy) was significantly correlated to higher depressive symptoms. The items measuring perception of control over circumstances was a mediating variable. These authors make broad assumptions regarding the meaning of types of work for individuals, these assumptions are not tested as part of the investigation. The authors’ discussion includes the statement that the benefit of social activities on well-being may be mediated by the sense of control they have over the activity.

A recent trend in the literature investigates sense of control as a mediating variable. Socioeconomic status and education have significant correlation with SRH as

previously discussed. One hypothesis for why this is so is that higher SES and advanced education bolsters sense of control. In a cross-cultural US-Japan sample, Kan et al. (2014) found that sense of control significantly mediated the association of education and social status with SRH across genders and countries. Turiano, Chapman, Infuma, Agrigoroaei & Lachman (2014) sought the mediating effect of sense of control on education and mortality in a middle-aged US sample. They found a significant interaction effect between education and control beliefs on mortality risk. For lower educated individuals, higher control beliefs were associated with decreased mortality risk but for more educated individuals, control beliefs had no effect on mortality risk. Ward (2012) used Health and Retirement Study (HRS) data to examine the possible mediating effect of sense of control (measured with personal mastery and perceived constraints scale) for demographic characteristics effect on self-reported health measures. Findings included that overall, higher personal mastery and lower perceived constraints were associated with better SRH. However, these sense of control variables do not account for differences among demographic groups.

Results are mixed regarding sense of control as a mediating variable between demographics and SRH however, the direct association between sense of control and SRH is consistent in a positive direction. Autonomy is not a commonly used metric in research, but may play an important role in maintaining OW.

## **2.8 Evidence Related to Attitude**

The effects of happiness (likert scale) and optimism (“I feel things are going my way”) on OW as SRH have been studied to a limited extent in the older adult population.

For example, while older people are more likely to report poor SRH than younger people, age is a poor predictor of unhappiness. However, within individuals, poor health and unhappiness are highly positively correlated. (Subramanian, Kim & Kawachi (2005), p. 664). In a related finding, Segerstrom (2013) found that positive affect was a significant predictor for better SRH, especially for older people. Wurn & Benyamini (2014) focused on an optimistic view of the future and self-perceptions of ageing and their effect on physical and mental health outcomes. Their findings indicated that people who anticipated physical declines with ageing (negative self-perception of ageing) but were optimistic in spite of these anticipations were better able to maintain physical function and had lower depression scores. This relationship warrants further study, and again points to activity and physical function as an important mediating variable.

In studies across the adult lifespan, several studies support a positive relationship between SRH (OW) and happiness. In a regional Italian population Sabatini (2014) found that feeling happy increases the probability of reporting good SRH by 23.5%. Siahpush, Spittal, and Singh (2008) also examined the effects of happiness and life satisfaction on health in a sample of Australian adults. Their findings include that the chance of reporting excellent, very good, or good SRH over time is positively associated with baseline happiness, with a significant odds ratio (OR) of 1.5. They report that happiness is also positively associated with a lack of life-limiting health conditions and better physical health over time. The mechanism for these findings is unknown, however Sabatini (2014) hypothesizes that there may be two contributing mechanisms: 1. That being happy prevents potential autonomic nervous system responses that can be

damaging to health; and/or 2. That happier people are more likely to engage in healthy behaviors such as sports (p. 184).

Beyer, Wolff, Warner, Schulz, and Wurm (2015) recognize this second hypothesis from Sabatini (2014) as a “behavioral pathway” in which differences in SRH may be explained by an individual’s perception of the aging process. Their attitude metric is not happiness, but rather self-perception of ageing, however the overall sentiment is closely related. They conclude that physical activity does indeed mediate the relationship between attitude (as self-perception of ageing) and health over time. Positive self-perceptions are associated with higher levels of activity, which predict better health over time (Beyer, Wolff, Warner, Schulz, & Wurm, 2015, p.671) It is unclear if the metric of self-perceptions of ageing is closely related enough to happiness as an indicator of attitude.

For all adults, happiness may lead to better health over time either because happiness prevents physical damage (Sabatini, 2014), or because happier people are more likely to engage in healthy behaviors (Sabatini, 2004; Beyer Wolff, Warner, Schulz & Wurm, 2015). It is clear from existing literature that significant positive relationships exist between SRH (OW) and positive attitude (i.e. Siahpush, Spittal, & Singh, 2008). The current investigation is well suited to identify the presence of a mediating effect of attitude in the relationship between activity and OW.

## **2.9 Evidence Related to Relationships**

Humans are social creatures. Interactions with other humans are vitally important to our overall sense of well-being. Loneliness is recognized as a significant health danger

(Numella, Seppanen & Uutela, 2010), and has been associated with many negative health behaviors (Hawkey, Thisted & Cacioppo, 2009) and outcomes (Coyle & Dugan, 2012) including mortality (Luo, Hakley, Waite & Cacioppo, 2012). Social contact frequency is an important objective measurement of the social support network an older adult experiences.

In a 2014 review of studies examining personal relationships and SRH in older adults, Craigs, Twiddy, Parker & West examine 31 articles in search of causal evidence linking personal relationships and SRH. The causal link remains absent from current literature. Correlational link for social contact frequency and SRH, however, can be found in at least one study: Mikler & Langauser (1988) found evidence that more social contact is associated with better SRH over time. Two articles reviewed failed to find a significant association between social contact frequency and SRH (Hinerlong et al., 2007; Rozario et al., 2004 cited in Craigs, Twiddy, Parker & West, 2014). Another article not included in Craigs and colleagues' review also failed to find a significant relationship between social contact frequency and SRH in a Finnish older adult sample (Nummela, Sulander, Karisto & Uutela, 2009). Social participation and access to help, however, were significant predictors of SRH. All three components were included in Nummela and colleagues conceptualization of "social capital." Social contact frequency alone may not be a robust indicator of SRH.

A reduction in social contacts or network size is often an expected part of ageing. Loneliness, however, reflects a mismatch between "the desired and actual levels of social interaction" (Coyle & Dugan, 2012, p.1348). Using Health and Retirement Study (HRS) data, Coyle & Dugan (2012) found that loneliness and social isolation were not



significantly correlated. Loneliness was related to mental health problems, while isolation was associated with higher odds of poor/fair SRH (Coyle & Dugan, 2012). In their secondary analysis, researchers utilized a portion of the HRS sample,  $n=11,825$ , a stratified random population sample of the United States. This large sample size and rigorous sampling technique lends strength to the conclusions.

Alpass and Neville (2003) also found significant relationship between loneliness and depression. Their investigation was limited by small sample size and included exclusively male participants. In their examination, social network size did not have a significant association with depression; social contact frequency was not assessed. In a French adult sample, a combination of objective and subjective measures for social isolation including “felt alone in previous day,” “received no phone call in previous day,” and “no friends” were used. The researchers conclude that socially isolated people report lower SRH, and this effect is more significant for individuals with lower income level (Heritage, Wilkinson, Grimaud & Pickett, 2008). Measures used to evaluate social contact are not consistent across studies, and evidence for the effect of social contact on SRH is mixed. Loneliness has more robust evidence for its effect on physical and mental SRH.

In a longitudinal examination conducted by Nummela, Seppanen, & Uutela (2010) in Finland, never or seldom experiencing loneliness at baseline was a strong predictor for future good SRH. Among men, reductions in loneliness over time also strongly predicted good health. Using a longitudinal HRS sample, Luo, Hakley, Waite & Cacioppo (2012) found a reciprocal 2-year cross-lagged effect between loneliness and SRH. In their analysis, SRH has a stronger and more significant effect on loneliness than

the reciprocal direction. While social relationship measures had no relationship with mortality, lonely individuals had a significantly increased odds ratio of mortality (OR=1.14). Luo and colleagues' analysis also found a reciprocal 2-year cross-lagged effect between loneliness and functional limitation. In an earlier study, Hawkey, Thisted & Cacioppo (2009) also found loneliness to be an independent risk factor for poor physical activity, and the presence of loneliness made inactivity more likely over time in an American sample. Netz, Goldsmith, Shimony, Arnon & Zeev (2013) confirmed this relationship in a sample of older Israeli women.

The association of loneliness with physical inactivity may explain some of its effect on SRH. Coyle and Dugan (2012) posit that the mechanism by which loneliness effects older adults may itself be physical by triggering an autonomic nervous system stress response. The role of loneliness and social contact frequency on SRH, and a possible interaction with or mediating effect via physical activity was examined in this investigation.

## **2.10 Summary of Evidence**

The MTB model is unique in its application of the 5 balance variables: health, activity, autonomy, attitude, and relationships to explain the outcome variable, OW. One investigation located in the review did undertake a similar investigation with Korean older adults (Jin-Kyoung, Soon-Lae, Do-Young & A-ri, 2014). Their findings support further investigation into the interaction between the balance variables in a non-Korean population was undertaken in this investigation. The addition of autonomy as a variable

and a more robust measure for relationships will make this investigation unique from their study.

The intricacy and complexity of the concept of SRH, or OW, is apparent in its many relationships to physical, psychological, and demographic factors. As the outcome measure in the MTB model, it is further explored and placed into context in the life of the older adult participants captured in the NSHAP database sample. Interestingly, OW can be high even for individuals with significant chronic disease presence and/or physical disability. The ability to maintain high OW in the presence of chronic disease is of particular interest for this investigation. The MTB model may prove explanatory for how a community dwelling older adult maintains OW in the presence of chronic disease.

The existing literature on each of the variables when considered separately points to the importance of each of the five balance variables on the outcome of OW. Health, or the presence of chronic disease, is correlated with OW (SRH) with more chronic diseases correlating with poorer SRH (Hoeymans, Feskens, Kromhout & van de Bos, 1999). However, this relationship may not be linear in nature. In all but the oldest-old age group there is not much difference between having one disease and having several. The additive burden of subsequent diseases is smaller than the first disease. (i.e. Galenkamp, Braam, Huisman & Deeg, 2011). Poor scores on activity measures have been correlated with poorer OW (SRH) (i.e. Idland, Smastuen, Engedal & Bergland, 2014). Autonomy has not been studied in relationship to OW (SRH) but related variables support the presence of a positive relationship (i.e. Ward, 2012). Positive attitude correlates with better OW (SRH) (i.e. Sabatini, 2014). Relationships, or a lack thereof and subsequent loneliness correlates with poorer OW (SRH) (i.e. Luo, Hakley, Waite & Cacioppo, 2012).

Significant interactions between the balance variables were discussed in the existing literature. Paffenbarger, Wing, & Hyde (1978) found that activity can prevent chronic disease (Activity – Health). Sabatini (2014) and Beyer, Wolff, Warner, Shulz, & Wurm (2015) suggest a “behavioral pathway” for the relationship between attitude and OW, mediated through activity (Attitude – Activity – OW). Wurm & Benayamini (2014) suggest a protective effect of attitude on physical function (Attitude-Activity). Luo, Hawkley, Waite & Cacioppo (2012) found positive reciprocal relationship between loneliness and functional limitation, and reciprocal negative relationship between loneliness and OW (SRH). These relationships are mapped in the hypothesized MTB model, Figure 2.

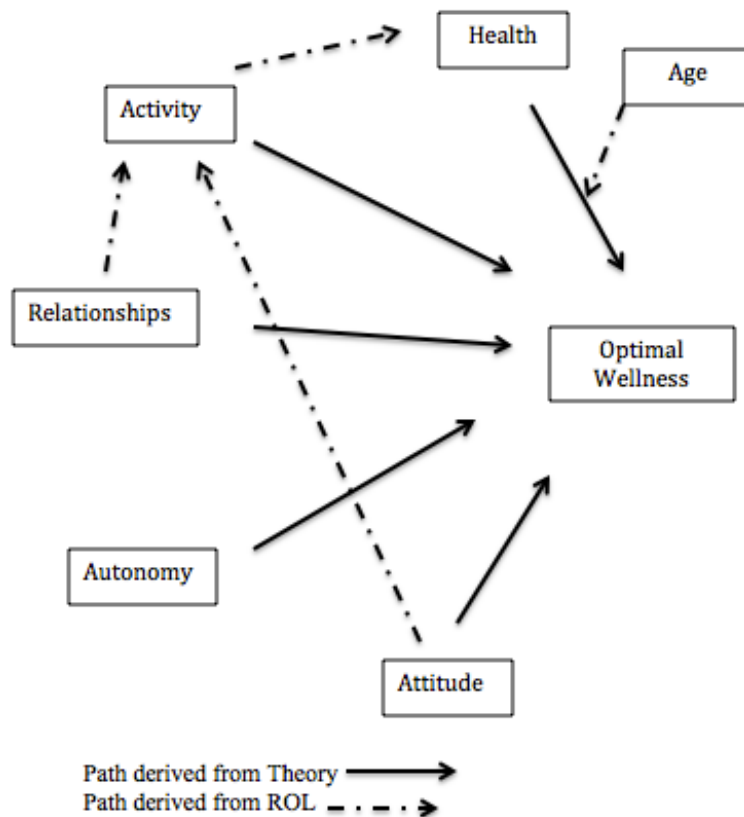


Figure 2. Hypothesized MTB model diagram.

## **CHAPTER 3**

### **METHODS**

#### **3.1 Introduction to Methods**

This investigation utilized a secondary analysis of the existing nationally representative data set National Social Life, Health, and Aging Project (NSHAP); Cross-sectional quantitative methods, specifically path analysis, were utilized to examine relationships among the variables health, activity, autonomy, attitude and relationships in Dr. Cynthia Jacelon's Theory of MTB (2010) described previously. This chapter will describe secondary analysis, evaluate the NSHAP database and its appropriateness for this investigation, and describe the quantitative method of path analysis that was utilized in data analysis.

#### **3.2 Secondary Analysis**

Secondary analysis is a research strategy in which existing data from a previous investigation are utilized to answer new research questions. Any appropriate research methodology can be applied to an existing data set to yield new results (Doolan & Froelicher, 2009; Magee, Lee, Guiliano, & Munro, 2006). Secondary analysis has been established as a valid, economical, and efficacious way to expand nursing knowledge (Clarke & Cossette, 2000; Magee, Lee, Guiliano, & Munro, 2006). One appropriate use for secondary analysis is to test nursing theory (Clarke & Cossette, 2000; Magee, Lee, Guiliano, & Munro, 2006).

**3.2.1 Benefits and Limitations.** As with any research strategy, there are benefits and limitations to a secondary analysis approach, summarized in Table 2. A secondary analysis approach can access a large group of research subjects without the substantial investment of time and money necessary to recruit, access, interview or survey, and thank the subjects. A researcher with a small budget or limited time can experience the benefits of a large representative sample without the investment (Clarke & Cossette, 2000; Doolan & Froelicher, 2009; Magee, Lee, Guiliano, & Munro, 2006). Additionally, no research subjects are involved in the process, and therefore there is no risk to human subjects incurred during a secondary analysis of de-identified data (Doolan & Froelicher, 2009).

The primary limitation of a secondary analysis approach is the secondary analyst's lack of control over the initial conditions of data collection. To overcome these limitations, a secondary analyst "must carefully consider if the existing data set's available power and quality are adequate (Doolan & Froelicher, 2009, p.210)" to answer the proposed research question(s). A secondary limitation may stem from inadequate documentation of the original research operations to allow for thorough data set evaluation (Liang & Lawrence, 1989). A detailed discussion of data set evaluation follows. Clarke & Cossette (2000) suggest a simultaneous examination of the available data sets and their limitations while framing and refining the research questions to accomplish a project design with overall high theoretical integrity (p.112).

Table 2  
*Benefits and Limitations of Secondary Analysis*

<u>Benefits</u>	<u>Limitations</u>
Less time	Lack of control over data collection
Lower cost	Lack of control over sampling strategy
No risk to human subjects	Constraints of existing data set

### 3.3 Database Evaluation

Evaluation of the data set is accomplished on 3 axes: sampling, measurement, and ecological validity. It is vitally important that adequate documentation is available to engage in thorough examination of the data set on these axes (Liang & Lawrence, 1989).

The original sampling strategies and the reasoning for decisions made in this process will reveal to the secondary analyst if the chosen sample is appropriate to answer the chosen research questions. An oversampling of a particular group, or specific inclusion and exclusion criteria may have been prudent in the original research project, but may not apply to the secondary analysis (Clarke & Cossette, 2000; Doolan & Froelicher, 2009). These decisions made in the original data collection may impact the representativeness of the overall sample and should be taken into consideration when considering the generalizability of the secondary analysis findings (Clarke & Cossette, 2000). Missing data and drop out over time are also important considerations, and the secondary analyst must decide if the original researcher's margins of acceptability coincide with their own (Doolan & Froelicher, 2009; Magee, Lee, Guiliano, & Munro, 2006).

The validity of the relationship between existing indicators in the data set and the concepts of interest in the secondary analysis is vital to a high quality secondary analysis

(Liang & Lawrence, 1989). The quality of the instruments and measures employed by the original researcher must be evaluated alongside the theoretical framework “fit” between the original researcher’s measure used and the secondary analyst’s concept of interest (Magee, Lee, Guiliano, & Munro, 2006). For the measurement of the secondary analysis concept of interest to be valid, the measure employed by the original researcher must fit the theoretical frame and avoid conceptual slippage (Clarke & Cossette, 2000).

Examining the recency and conditions of data collection, and considering any important historical or environmental effects that may impact the responses of the sample at the time of collection as compared with current conditions preserves ecological validity in secondary analysis (Clarke & Cossette, 2000; Doolan & Froelicher, 2009; Magee, Lee, Guiliano, & Munro, 2006). Ensuring that the conditions under which the original data were collected match with the current “real world” being considered by the secondary analyst improves applicability of findings. Each of the three axes, sampling, measurement, and ecological validity are applied to the examination of the NSHAP database to evaluate its use in this investigation below.

**3.3.1 National Social Life, Health, and Aging Project (NSHAP).** The National Social Life, Health, and Aging Project (NSHAP) was conducted by the National Opinion Research Center (NORC) at the University of Chicago with funding from the National Institutes of Health (NIH) including National Institute on Aging (NIA), Office of Women’s Health, Office of AIDS research, and Office of Behavioral and Social Sciences research (Suzman, 2009). The project was designed by an interdisciplinary group of researchers also at the University of Chicago. As described on the NORC website entry for this project (NORC):



The National Social Life, Health, and Aging Project (NSHAP) is a longitudinal, population-based study of health and social factors, aiming to understand the well-being of older, community-dwelling Americans by examining the interactions among physical health and illness, medication use, cognitive function, emotional health, sensory function, health behaviors, social connectedness, sexuality, and relationship quality. (para1)

Wave 1 of data collection was completed July 2005- March 2006 (n=3,005) and Wave 2 was completed August 2010- May 2011 (n=3,337) (NORC). The NSHAP sample is built on the national household screening data from the Health and Retirement Study (HRS), another NORC venture. This collaboration allowed for a complex, multistage area probability sample of community dwelling individuals born between 1920 and 1947 with oversampling of Hispanic and African American individuals (ICSPR para 8).

**3.3.2 Evaluation of NSHAP.** The NSHAP data was collected by a reputable group of researchers who undertook appropriate IRB review and received federal funding to undertake this data collection. The dataset and accompanying information is readily available for secondary analysis, as making the data available for such investigations was part of the initial intention of the project (Suzman, 2009). An entire issue of the *Journal of Gerontology: Series B* is dedicated to publication of methodological details to enable rigorous secondary analyses.

**3.3.2.1 Sampling.** The sampling strategy of the NSHAP is national, large scale, and attempts to achieve a representative group for older adults in the United States. Oversampling of African American and Hispanic households improves the representativeness of the sample. Individual households were screened for eligibility in

collaboration with screening for the Health and Retirement Study (HRS), another NIH funded venture. Eligible households were then randomly sampled. Under sampled persons included the homeless and those living in institutions. Due to the collaboration with HRS, individuals who were in a household partnership with an individual eligible for HRS were not sampled. These individuals included older adults living with adult children, siblings, unmarried partners, or unrelated housemates who would qualify for participation in HRS (O'Muircheartaigh, Eckman, & Smith, 2009). O'Muircheartaigh, Eckman, & Smith (2009) assert that their comparison of the sample to US Census data yielded a low 5% under coverage rate overall.

The sample is well suited to the proposed investigation in that a representative sample of older adults living in the US is ideal, and would not have been possible to achieve through data collection by a single researcher in the course of doctoral study. No particular inclusion or exclusion criteria were included in the original sampling strategy (aside from age), as the sample was recruited to answer generalized questions about the relationships between social factors such as sexual relationships to health in older adults. The overall response rate was 75.5% (Suzman, 2009), which minimized nonresponse bias to an acceptable degree according to Lindner, Murphy, and Briers (2001). Lindner, Murphy, and Briers (2001) state that a response rate below 75% would indicate a need for the researchers to try again to obtain information from non-respondents or make a comparison of non-respondents to respondents for interpretation. Due to the secondary analysis procedure, it is not possible to alter the response rate in this dataset, but the rate was considered in result interpretation. Researchers did provide individualized letters addressing the concerns of respondents and also increased monetary incentive to

participate to minimize nonresponse bias. Individual items, including bio measure collection, had somewhat higher nonresponse bias than other items and each measures response rate should be considered when extrapolating results (O’Muircheartaigh, Eckman, & Smith, 2009). To help compensate for these flaws, weights are provided as a tool for secondary analysts to “provide unbiased estimates of population characteristics (O’Muircheartaigh, Eckman, & Smith, 2009).” Weights are provided to compensate for HRS sampling issues, and also nonresponse rates and details are provided by O’Muircheartaigh, Eckman, & Smith (2009) to prevent overestimation in confidence intervals and standard error.

**3.3.2.2 Measurement.** Pilot testing of the initial NSHAP questionnaire revealed a burdensomely long interview. In response, the researchers chose to modularize the data collection process, with core measures and additional modules applied in one of 6 possible subsets that were successfully fidelity checked for randomness. Two effects are seen in the data as a result of this modular design; First, the total number of interviewed individuals is fewer for each individual measure than the total N, and therefore there are larger variances in these estimates. Second, some items may have variability in the way they were presented (in-person interview or written questionnaire). Mode of collection may have some effect on the responses to these items (O’Muircheartaigh, Eckman, & Smith, 2009).

The “main object of this [NSHAP] research was to provide the means by which to understand the variability in health of older adults by integrating biological and social measures (Williams, Pham-Kanter, & Leitsch, 2009, p.i73).” Jacelon’s Theory of MTB describes how community dwelling older adults “balanced activity, attitude, autonomy,

health, and relationships within their daily lives” (Jacelon, 2010, p.17). The theoretical congruence between the investigations is high. The NSHAP dataset addresses, to some degree, each variable in Dr. Jacelon’s work. Both investigations set out to understand the dynamic balance of community-dwelling older adults health, interpersonal relationships, and physical and social individual characteristics. The fit and quality of each individual measure chosen will be discussed in detail in the following section.

**3.3.2.3 Ecological Validity.** The first wave of NSHAP data was collected in 2005-2006, and the second wave in 2010-2011. The data is extremely current and the chosen measures do not have any known historical effects. The recent introduction of universal health care coverage is a significant event that may yield historical effect, but it is unlikely that this population would be significantly impacted, as all individuals over age 65 had been eligible for Medicare coverage.

Table 3  
*Highlights of NSHAP Evaluation*

<u>Criterion</u>	<u>NSHAP</u>	<u>Comments</u>
Sampling	<ul style="list-style-type: none"> <li>• National area probability sample</li> <li>• N=3,005</li> <li>• Community dwelling older adults 57-85 years of age</li> <li>• Subgroups balanced for age and gender</li> <li>• Subgroups do not all include every measure</li> <li>• Oversampling of Hispanic and African American</li> <li>• Overall response rate 75.5% (Suzman, 2009)</li> <li>• Biomarker response</li> </ul>	<ul style="list-style-type: none"> <li>• Random sampling increases generalizability</li> <li>• Impressive size group of my population of interest</li> <li>• Usable sample size will be less than total N</li> <li>• Excellent response rate overall</li> <li>• Vaginal swab data is not of interest in this proposed</li> </ul>

	<p>rate was reduced for vaginal swabs (67.5%) (missing data)</p> <ul style="list-style-type: none"> <li>• Other measures all had high cooperation rates</li> <li>• Innovative, individualized recruitment to improve response rate (Smith et al., 2009)</li> <li>• Professional rigorously screened and trained data collectors (Smith et al., 2009)</li> <li>• Specific data about distributions of physical health and chronic condition measures are presented</li> <li>• Initial data collection measures were limited according to the factors of home environment, time, cost, use by field interviewers (Williams, Pham-Kanter, &amp; Leitsch, 2009)</li> <li>• Examination of specific variables and chosen measures.</li> <li>• Theoretical frame of measures is broad and designed to understand variability in health outcomes according to biological and social measures (Williams, Pham-Kanter, &amp; Leitsch, 2009)</li> </ul>	<p>investigation</p> <ul style="list-style-type: none"> <li>• Improved response rate improves generalizability of the sample</li> <li>• Lots of attention was paid to initial data quality</li> <li>• Detailed information on topics of interest readily available in publication allowing for informed choice of important variables</li> <li>• A single researcher in doctoral scope could never achieve better data on this scale</li> <li>• This is compatible with Jacelon's theory of MTB, details in discussion paragraph.</li> </ul>
Measurement		
Ecological Validity	<ul style="list-style-type: none"> <li>• Wave 1 Data Collection 2005-2006</li> <li>• Wave 2 Data Collection 2010-2011</li> </ul>	<ul style="list-style-type: none"> <li>• Adequately current</li> <li>• No significant historical effects related to variables of interest</li> </ul>

### **3.4 Data Protection Plan**

The NSHAP database was obtained from the Inter-university Consortium for Political and Social Research (ICPSR) at the University of Chicago. The request for release of data is included as Appendix B. The database is maintained under a restricted use agreement, but is readily available for release with signed user agreement and adequate plan for data protection. In order to meet this requirement, data have been maintained as described here.

A single MacBook Pro was the primary computing environment for data analysis. A secure removable storage unit was the location for data storage. The computer stands alone for personal use with no networked connections. The computer was stored in a locked private home with no public access and is password protected. The removable storage holding the data has been kept in a locked container when not in use. No backup copies have been made. No electronic transmittal of data was conducted. The PI did share physical access to the removable storage containing the data with academic advisors for purposes limited to academic advisement on data analysis process. The PI has ensured that no copies were made of the data. Physical printouts of raw data were not created.

### **3.5 Data Analysis Strategy**

The overarching goal for data analysis was to discover if the proposed MTB model is supported by the NSHAP dataset. Path analysis technique was employed.

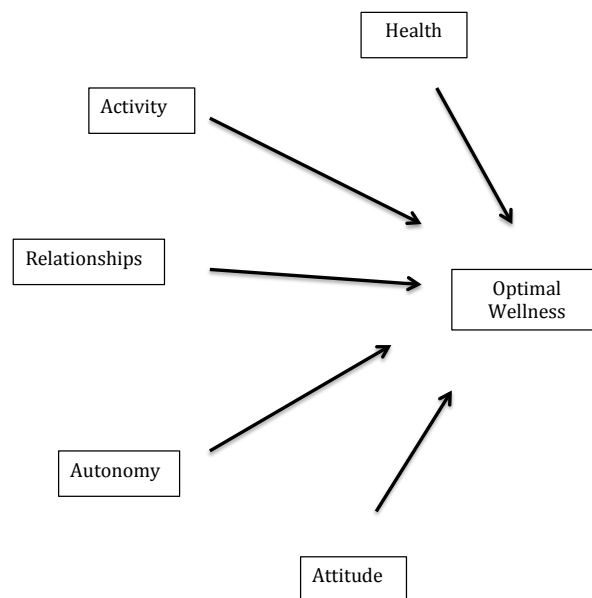
**3.5.1 Path Analysis.** Path analysis is based on simple regression techniques, but allows for a richer understanding of the relationships between and among the examined variables (Kellar & Kelvin, 2013). Simple multiple regression allows for prediction of Y

based on a collection of X variables. Path analysis builds on this to examine both the direct and indirect effects of the various X variables on the Y variable. This analysis examined the paths in the MTB Model to help understand the effect of the 5 balance variables on the outcome variable of OW as well as the hypothesized indirect effects among balance variables. Analysis of the paths provided information about the fit of the model to the NSHAP database.

**3.5.2 Primary Research Questions.** The goal of the study was to discover if the proposed model is supported by the dataset and to revise the model based on the findings from the initial path analysis. The specific research questions answered address the direct, mediating, and moderating effects among the variables suggested in the review of literature.

Direct Effects:

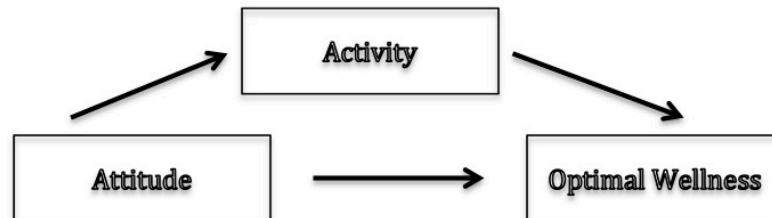
1. What is the direct effect of each balance (X) variable on OW? (P61, P62, P63, P64, P65)



*Figure 3.* Diagram of research question 1.

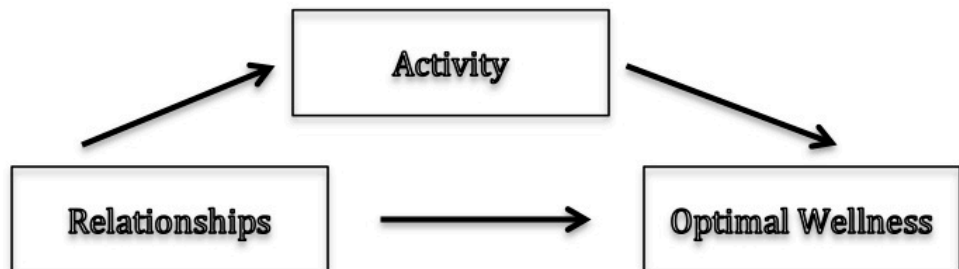
Indirect (Mediating) Effects:

2. Does activity (X2) mediate the effect of attitude (X4) on OW (Y)? (P24)



*Figure 4.* Diagram of research question 2.

3. Does activity (X2) mediate the effect of relationships (X5) on OW (Y)? (P25)



*Figure 5.* Diagram of research question 3.

4. Does health (X1) mediate the effect of activity (X2) on OW (Y)? (P12)



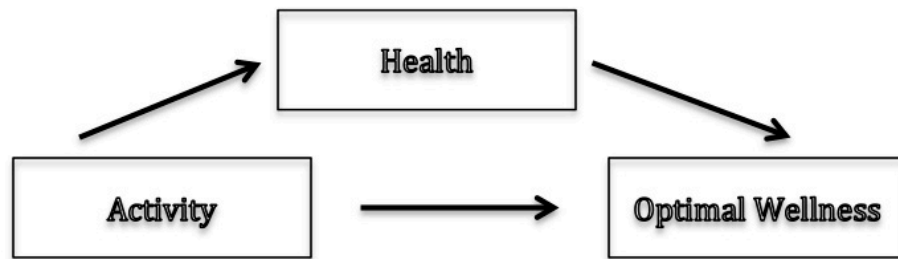


Figure 6. Diagram of research question 4.

Moderating Effect:

5. Is age a moderating variable of the relationship between health and OW?

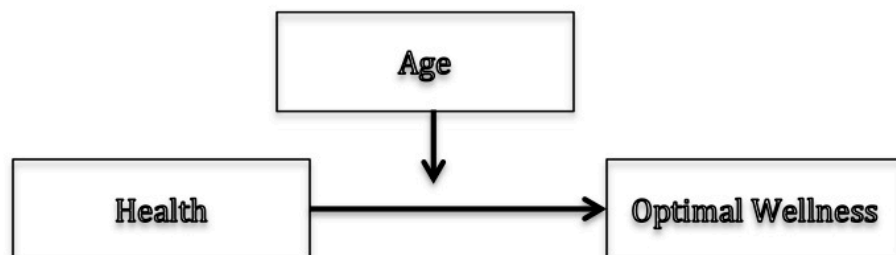


Figure 7. Diagram of research question 5.

**3.5.3 Power.** The total sample size of the NSHAP dataset Wave 1 is 3,005 and Wave 2 is 3,337.

**3.5.4 Procedure.** The procedure for completing data analysis began by seeking IRB approval. The dataset was then obtained and prepared for analysis. Relevant

theoretical and statistical assumptions were checked to ensure that path analysis technique is appropriate. The results are discussed in chapter 4. The path analysis technique was then executed and interpreted as described below.

**3.5.5 Direct Effects.** The MTB model shows direct effects from the five balance variables health, activity, autonomy, attitude, and relationships on the outcome variable of OW. These direct effects represent the original conceptualization of the model from Jacelon (2010). Review of the literature supported the presence of each of the direct effects as described in Chapter 2.

The presence of direct effects was tested using regression model 1, described in Table 4. The beta coefficients for each variable in this regression where significant indicate the presence and relative strength of the direct effects.

**3.5.6 Mediating Effects.** The mediation of activity on the relationship between attitude and OW was suggested by Sabatini (2014) and Beyer, Wolff, Warner, Schulz, & Wurm (2015). These authors found evidence for a “behavioral pathway” wherein attitude, and its subsequent effect on OW, is mediated by physical activity level. In other words, a person’s attitude has a significant effect on their physical activity level, which in turn significantly affects OW as SRH.

Luo, Hakley, Waite & Cacioppo (2012) suggested the mediation of activity in the relationship between relationships and OW. Their findings confirm the strong direct effect of loneliness (relationships) on SRH (OW). They also found a strong significant association of loneliness (relationships) on functional limitations and physical exercise (activity). While the researchers conclusions do not confirm the presence of an

interaction effect due to their research design, this potentially important mediating effect was explored in this study.

The mediating effect of activity on relationships and attitude was tested with regression model 2, described in Table 4. The significance of the beta coefficients in this regression equation were used to populate the path diagram. Each of the three mediation effects were then further examined individually using the procedure suggested by Baron & Kenny (1986).

Health mediating the relationship between activity and OW is suggested by several authors in the literature review. Paffenbarger, Wing, & Hyde (1978) and many others have found that physical activity (activity) reduces the number of chronic diseases (health) an individual suffers from. This in turn, may have a significant interaction effect on OW and was tested in this investigation. Regression model 3 was designed to test the presence of this interaction and utilized to populate the path diagram. The Baron & Kenny procedure was then repeated for this mediation effect.

To determine if the mediating effect was partial or full, the procedure described by Baron & Kenny (1986) was utilized on all three mediation effects. Baron & Kenny describe mediation as a causal chain in which one variable (M) mediates the relationship between two other variables (X & Y). They suggest a three-regression procedure to evaluate the presence and partial/full nature of a mediation effect. First, the independent variable (X) must be shown to affect the mediator (M). Second, the independent variable must affect the dependent variable (Y). Then, in a third equation the effect of X on Y must be less than in previous regression. If the effect were reduced to zero, this would

indicate full mediation. A reduction to more than zero maintaining statistical significance indicates a partial mediation effect.

**3.5.7 Moderating Effect.** The hypothesized moderating effect of age cohort group on the relationship between health and OW was suggested by Galenkamp, Braam, Huisman & Deeg (2011). Their findings suggest that individuals in the over 85 age category are less effected in their rating of SRH by the number of chronic health conditions. To test the moderating effect of age, the following regression model was built:

$$1. \text{ OW} = \text{constant} + b_1\text{health} + b_2\text{age} + b_3\text{age*health}$$

The statistical significance of the regression coefficient,  $b_3$  was tested. Statistical significance of  $b_3$  would indicate the presence of a significant moderating effect.

**3.5.8 Summary of Regression Models.** Three regression models were required to calculate all the path coefficients and populate the path diagram. The significance and beta coefficient of the paths provides valuable information about the fit of the model to the data set. The three regressions are described in table 4.

Table 4  
*Regression Models*

	<u>Dependent Variable</u>	<u>Independent Variable(s)</u>
Regression Model 1	OW	Health, Activity, Autonomy, Attitude, Relationships
Regression Model 2	Activity	Relationships, Attitude
Regression Model 3	Health	Activity

$$1. \text{ OW} = \text{constant} + b_1\text{health} + b_2\text{activity} + b_3\text{autonomy} + b_4\text{attitude} + b_5\text{relationships}$$

2. Activity = constant +  $b_1$ relationships +  $b_2$ attitude
3. Health = constant +  $b_1$ activity

These three regression models make up the primary findings for the path analysis. These models underwent the full battery of assumptions testing as detailed in Chapter 4.

Additional regression equations were utilized to test the moderating effect of age, and also to complete the Baron & Kenny procedure to interpret the mediation effects.

**3.5.9 Construction of Results Figure 13 and Table 9.** Figure 13 and Table 9 were constructed using the regression beta coefficients from the three primary regression models described in Table 4. The lines representing the direct and indirect paths in the hypothesized MTB model were weighted to represent visually the effect size. To create Table 9, each direct and indirect path between the balance variables and OW were examined and computed to determine the direct, indirect, causal, and non-causal effects. For example, to calculate the table values for the variable “health” the following procedure was followed: The direct causal effect is the direct line following the diagrammed directional arrow to OW represented by P61 (-0.19). Indirect causal effects are those that also follow the diagrammed line direction, but are indirectly connecting health to OW, none exist in this diagram. The total causal effect is calculated by adding these two figures (-0.19 + none = -0.19). Non-causal effect in the model is calculated by adding together the path coefficients that do not follow the diagrammed line direction, but do connect the balance variable to the OW. For the variable of health, the paths  $(p_{12} * p_{62}) + (p_{12} * p_{24} * p_{64}) + (p_{12} * p_{25} * p_{65})$  connect health and OW contrary to the diagrammed line (non causal) direction. The product of each non-causal path is then summed to represent the total non causal effect (-0.05) (Kellar & Kelvin, 2013). The

search for direct and indirect paths in the causal and non-causal directions and required calculations were completed for each balance variable. Results for all balance variables are shown in Table 9: Results. Also shown in this table are the correlation coefficients for each of the balance variables with OW. These correlation coefficients were obtained through Pearson correlation calculations performed in SPSS.

### **3.6 Methods Summary**

This chapter described the secondary analysis approach, evaluated the NSHAP database and found it to be appropriate for this investigation, and diagrammed and described the procedure undertaken for analysis. Results from the regression analyses and the path analysis model constructed are reported in Chapter 4, Results.

## **CHAPTER 4**

### **RESULTS**

#### **4.1 IRB Approval and Acquisition of the Data**

The University of Massachusetts Amherst IRB determined that the project was not classified as human subjects research and did not require further review by the IRB. The Memorandum provided to the researcher on February 9, 2016 is Appendix A. This memorandum, along with the data protection plan were provided to the NSHAP project director via US Mail as required. Access to the database files was provided to this researcher on March 16, 2016.

#### **4.2 Dataset Preparation**

The NSHAP database was checked for missing data. Missing data did not represent a systemic trend in the variables of interest for this study. Individuals with missing data were included in this investigation as the missing data points are presumed to be random. The data were moved into an SPSS database for analysis.

#### **4.3 Assumptions Checking**

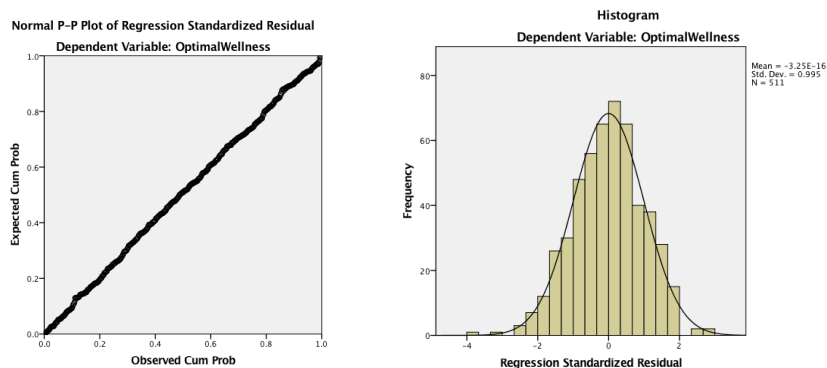
In order to use a path analysis approach the following theoretical and statistical assumptions were assessed to ensure this was an appropriate analysis. First, the underlying assumptions for multiple regression analysis (4.3.1-4) were tested to ensure that this approach was appropriate because multiple regression is the statistical procedure

that underlies path analysis. Then, the assumptions specific to a path analysis approach (4.3.5-11) were addressed.

A total of three regressions were run using SPSS functionality to complete the statistical procedure for path analysis as reported in Chapter 3, Table 4. Regression assumptions are reported for the three outcome variables: OW, activity, and health.

**4.3.1 Outcome Variable is Continuous and Normal.** In this investigation three outcome variables were utilized in the regression equations, OW, activity, and health. Two visualizations of normality testing were generated to assess if the outcome variables have a normal distribution: a histogram and P-P plot of standardized residuals. Standardized residuals represent the difference between values in the dataset and regression standardized predicted values. The residual is the difference between expected and actual, and the standardized residual is the residual divided by standard error (Kellar & Kelvin, 2013). To meet this assumption, the histogram of standardized residuals should resemble a bell curve and the P-P plot of standardized residuals should resemble a straight line.

OW has a normal-appearing P-P plot and normally distributed histogram of standardized residuals, shown in Figure 8.



*Figure 8.* P-P Plot of Regression Standardized Residual (left) and Histogram of Regression Standardized residual (right) for outcome variable OW.



The outcome variable of activity does not have a normal appearing P-P plot, and has a slightly skewed histogram of standardized residuals, seen in Figure 9.

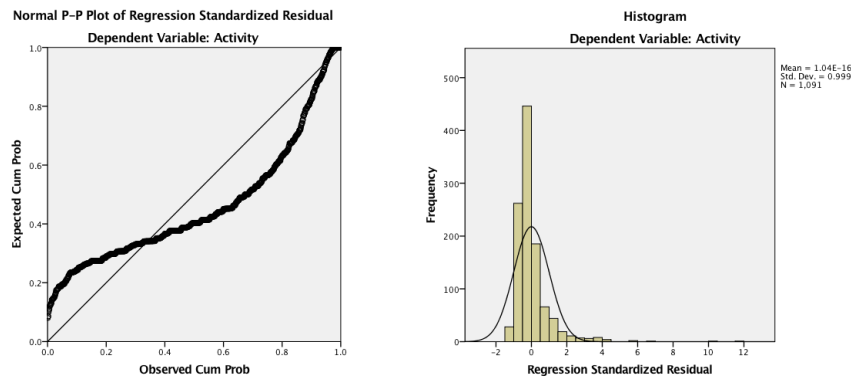


Figure 9. P-P Plot of Regression Standardized Residual (left) and Histogram of Regression Standardized Residual (right) for outcome variable activity.

The outcome variable health has a somewhat abnormal appearing P-P plot, and histogram of standard residuals with a near-normal appearance.

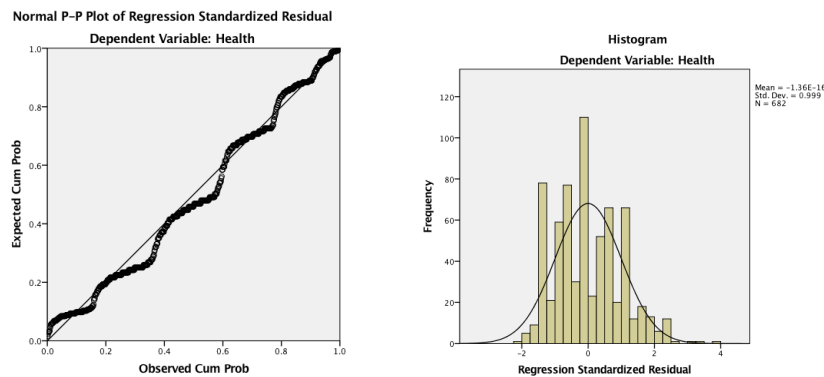
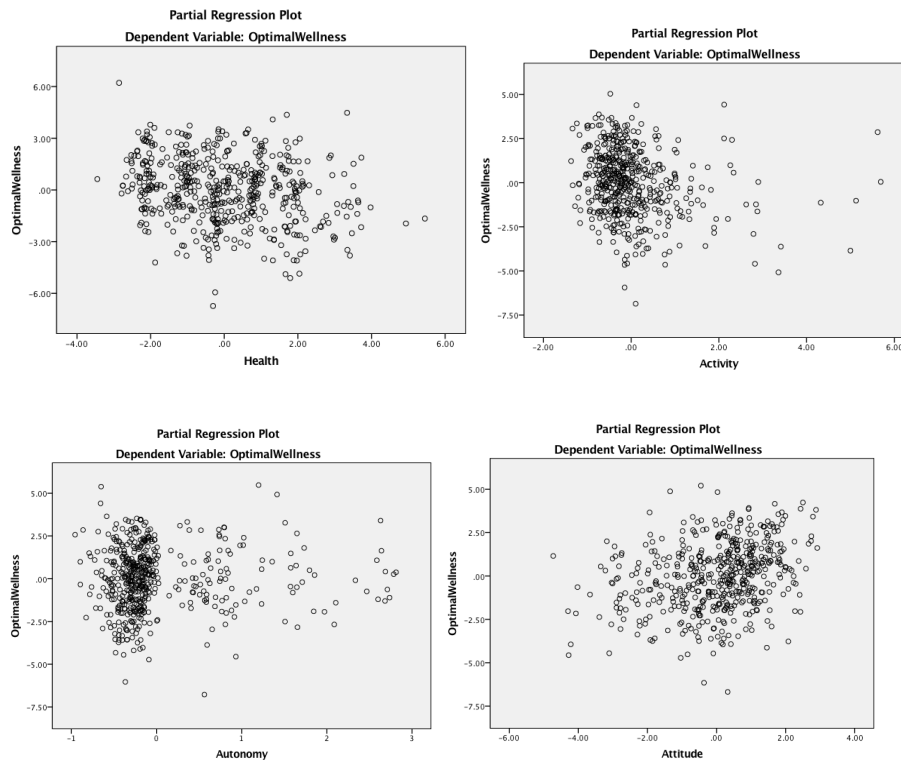


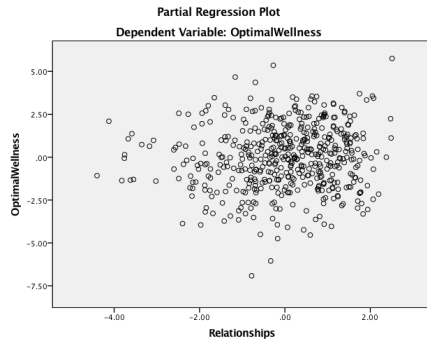
Figure 10. P-P Plot of Regression Standardized Residual (left) and Histogram of Regression Standardized Residual (right) for outcome variable health.

The presence of slight non-normality in the outcome variables of activity and health are considered as limitations to this investigation.

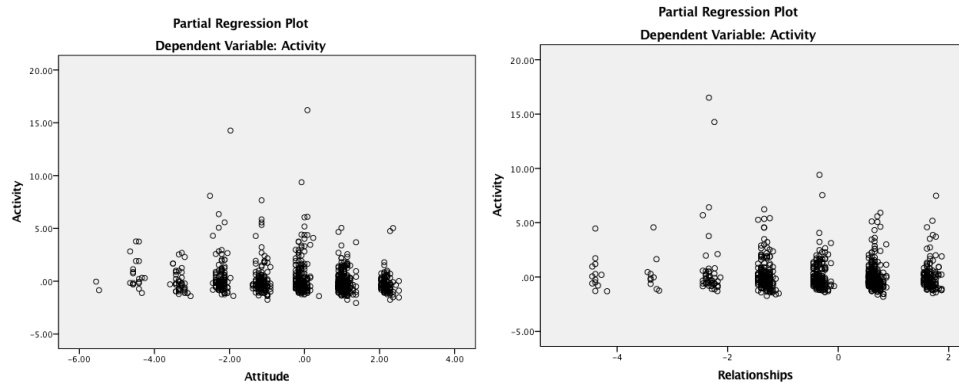
**4.3.2 Assumption of a Representative Sample.** In order to make inferences that the statistical outputs apply to a particular population, the sample utilized must accurately represent this population. The NSHAP data collection process (as previously described) was nationally representative, and based on reported information this researcher is confident that the NSHAP sample represents older Americans well.

**4.3.3 Assumption of Homoscedasticity.** The assumption of homoscedasticity is met when the dependent variable exhibits similar variance across all values of the independent variable. This assumption was tested by creating residual scatter plots of ordered residuals produced through assumptions testing in SPSS programming. Shown below, the plots for each of the outcome variables indicate visually that the data set meets the assumption of homoscedasticity by appearing randomly distributed.





*Figure 11.* Partial Regression Plots for dependent variable OW with independent variables health (top left), activity (top right), autonomy (middle left), attitude (middle right), and relationships (bottom left).



*Figure 12.* Partial Regression Plots for dependent variable activity with independent variables attitude (left) and relationships (right).

**4.3.4 Assumption of Absence of Multicollinearity.** Multicollinearity is a situation in which two or more of the independent variables are so closely correlated as to be redundant. If this assumption is violated through high correlations ( $>0.85$ ) among variables, the resulting regression coefficients will be biased (Kellar & Kelvin, 2013, p.365). As reported in Table 6: Correlation testing, the highest correlation is .45, well under the margin for violation of this assumption suggested by Kellar & Kelvin (2013).

Collinearity statistics including tolerances and VIF were generated for the regression equations and are summarized in Table 5. In regression model 1 with outcome variable OW, no variable exceeded the chosen tolerance of  $<0.01$  as suggested by Kellar

and Kelvin (2013). VIF scores were all close to 1, also demonstrating the absence of multicollinearity. In regression model 2, where activity is the outcome variable, the assumption is also met. In regression models 3, where health is the outcome variable this is not applicable as there is only one independent variable and no possibility of multicollinearity.

Table 5  
*Multicollinearity Testing*

OW		
<u>Variable</u>	<u>Tolerance</u>	<u>VIF</u>
Health	.94	1.06
Activity	.93	1.07
Autonomy	.93	1.08
Attitude	.90	1.10
Relationships	.98	1.01
Activity		
<u>Variable</u>	<u>Tolerance</u>	<u>VIF</u>
Attitude	.99	1.00
Relationships	.99	1.00
Health		
Not applicable		

**4.3.5 Assumption of Correlation.** The first of the assumptions unique to path analysis, we assume that there is an observed and measurable relationship between X and Y. To test this, univariate correlations among independent and dependent variables were tested using SPSS correlation function. Significant ( $p < 0.01$ ) correlation coefficients were found for all variables (see Table 6).

Table 6  
*Correlation Testing*

Correlation with OW					
	<u>Health</u> -0.29**	<u>Activity</u> -0.38**	<u>Attitude</u> 0.45**	<u>Autonomy</u> -.19**	<u>Relationships</u> .18**
Correlation with Activity					
		<u>Attitude</u> -0.17**		<u>Relationships</u> -0.13**	
Correlation with Health					
		<u>Activity</u> 0.25**			
<i>Note.</i> * (p<0.05) ** (p<0.01)					

**4.3.6 Assumption of Causation.** This assumption dictates that X precedes Y in time. In this study, the 5 balance (X) variables exist conceptually prior to the measurement of (Y) OW as SRH. This assumption is supported by the original MTB theory (Jacelon, 2010) in which the 5 balance variables interact to create the concept of OW. No interpretation of causation was undertaken in this investigation, as the non-experimental design does not assure conditions for interpreting causation are met.

**4.3.7 Assumption of Nonspurious Relationship.** This assumption dictates that the relationships between variables are direct and causal. No interpretation of causation was undertaken for this investigation.

**4.3.8 If two independent variables are correlated and not influenced by any other variables, their relationship cannot be analyzed.** In this model, any two independent variables that correlate, but do not relate to the outcome variable cannot be included in path analysis interpretation. All independent variables in this model correlate with the outcome variables (see Table 6).

**4.3.9 Assumption of Interval-level Data.** The data provided by the NSHAP database is reported primarily as ordinal measurement scales. It is a common convention to utilize ordinal level data, particularly likert-scale items for this type of analysis. Interpretation of results is cautious due to the violation of this assumption.

**4.3.10 Assumption of Zero Measurement Error.** The secondary analysis approach of this investigation does not allow for manipulation of this assumption. The limitations inherent to the possible violation of this assumption are considered in interpretation of results.

Testing of the theoretical and statistical assumptions reveals several limitations, particularly in the regression models used to test the mediating effects of activity and health. Caution was exercised when interpreting these results. This investigation did not seek to make causal inferences, and this was also fundamental in results interpretation. The secondary analysis approach has also been addressed as a limitation.

#### 4.4 Descriptive Statistics

The descriptive statistics for this dataset are presented in Table 7, below. Of note, no individuals over the age of 85 are sampled.

Table 7  
*Sample Demographics*

Age	57-64 33.9% (1020)
	65-74 36.3% (1092)
	75-85 29.7% (893)
Gender	Men 48.4% (1454)
	Women 51.6% (1551)
Education Level	<High School 23.3% (699)

	High School 26.4% (793) Post-Secondary 28.5% (856) Bachelors + 21.9% (657)
Race	White 70.2% (2110) Black 16.9% (509) Non-Black Hispanic 10.1% (304) Other 2.3% (70)
Marital Status	Married 59.9% (1801) Divorced 22% (661) Never Married 3.7% (111)

Descriptive statistics were calculated for independent and dependent variables and are in Table 8: Descriptive statistics for independent and dependent variables.

Table 8

*Descriptive Statistics for Independent and Dependent Variables*

	<u>N</u>	<u>Range</u>	<u>Minimum</u>	<u>Maximum</u>	<u>Mean</u>	<u>Std. Dev.</u>
Health	1454	9.00	.00	9.00	2.31	1.62
Activity	1344	18.10	-1.76	16.34	-.12	1.46
Attitude	2770	7.76	-5.46	2.30	.04	1.63
Autonomy	2786	3	1	4	1.39	.77
Relationships	2472	6	0	6	4.32	1.30
OW	2459	11.66	-7.53	4.13	.09	2.37
<i>Note.</i> Variations in N are based on the systematic sampling strategy						

#### 4.5 Path Analysis Results

Running the SPSS analyses for the three regression models is the first step in the path analysis procedure. Three regression analyses were performed to obtain the beta coefficients needed to populate the path diagram and check the statistical significance of direct and indirect effects. The details of the regression analyses are presented here, reporting beta coefficients:

**4.5.1 Regression Model 1 – Direct Effects.**  $OW = \text{constant} + b_1\text{health} + b_2\text{activity} + b_3\text{autonomy} + b_4\text{attitude} + b_5\text{relationships}$

Result:  $OW = 0.095 + (-0.19)\text{health} + (-0.21)\text{activity} + (0.01)\text{autonomy} + (0.32)\text{attitude} + (0.08)\text{relationships}$

This regression model is significant overall ( $p < 0.01$ ) and the 5 balance variables account for 24.4% (R squared) of variance in OW. Health, activity, attitude ( $p < 0.01$ ) and relationships ( $p < 0.05$ ) are significant predictors while autonomy was non-significant ( $p = 0.76$ ) in this model.

**4.5.2 Regression Model 2.**  $\text{Activity} = \text{constant} + b_1\text{relationships} + b_2\text{attitude}$

Result:  $\text{Activity} = 0.4 + (-0.12)\text{relationships} + (-0.17)\text{attitude}$

This regression model is significant overall ( $p < 0.01$ ) and the independent variables relationships and attitude are significant predictors ( $p < 0.01$ ) that account for 4.3% (R squared) of the variance in activity.

**4.5.3 Regression Model 3.**  $\text{Health} = \text{constant} + b_1\text{activity}$

Result:  $\text{Health} = 2.41 + (0.25)\text{activity}$

This regression model is significant overall ( $p < 0.01$ ) and the independent variable activity is a significant predictor ( $p < 0.01$ ) that accounts for 6.1% (R squared) of the variance in health.

The beta coefficients from the three tested regression models were used to populate the path diagram model as shown in Figure 13. Line weights in the figure are scaled to show relative effect size. As pictured in Figure 13, the effects of attitude, activity, and health are the most substantial in the model. Attitude has the largest effect on OW.



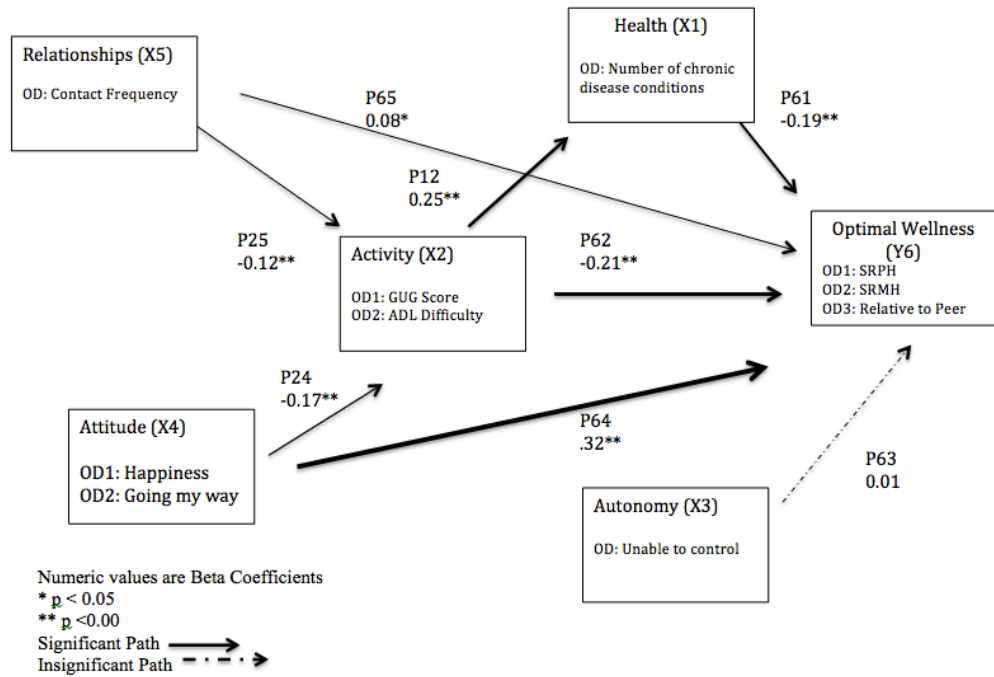


Figure 13. Path analysis results reported with beta coefficients. Line weight is representative of effect size.

The results are further described in Table 9.

Table 9  
Results

Variable	Correlation with OW	Total Effect (Causal + Non-Causal)	Causal Effect			Non Causal Effect
			TOTAL	Direct	Indirect	
Health	$r = -0.29^{**}$	-0.26	-0.19	-0.19**	None	-0.07
Activity	$r = -0.38^{**}$	-0.32	-0.26	-0.21**	-0.05	-0.06
Autonom	$r = -0.19^{**}$	0.01	0.01	0.01	None	None

y						
Attitude	$r = 0.45^{**}$	0.36	0.36	0.32^{**}	0.04	0.00
Relationships	$r = 0.18^{**}$	0.11	0.10	0.08^{*}	0.03	0.01
Note. ** indicates significance $p < 0.000$ * indicates significance $p < 0.05$						

## 4.6 The Research Questions Answered

The construction of the results figure and table allowed for interpretation of the numbers to answer the posed research questions as detailed below.

### 4.6.1 Direct Effects. 1. What is the direct effect of each balance variable on OW?

This research question was answered as part of the construction of the path diagram presented above, with the direct paths (p61, 62, 63, 64, and 65) showing the direct effect expressed as Beta coefficient of each balance variable on OW.

**4.6.1.1 Health.** The beta coefficient for the direct effect of health on OW in the model is -0.19 significant at  $p < 0.01$  level. This is shown in the diagram as p61. Health is the measure of number of conditions an individual self-reported, therefore a high “health” score indicates a high level of disease burden. The negative relationship indicates that for any increase in disease burden (health), OW is lowered. This was the expected direction of relationship and is significant within the model. The total effect or the sum of all causal (direct & indirect) and non-causal paths from health to OW is -0.26, comprised of the direct, indirect, and non-causal paths  $(p61) + (p12 * p62) + (p12 * p24 * p64) + (p12 * p25 * p65)$ .

**4.6.1.2 Activity.** The beta coefficient for the direct effect of activity on OW in the model is -0.21 indicating a significant ( $p < 0.01$ ) negative relationship ( $p62$ ). Activity is the combined variable of GUG score and ADL difficulty. High scores for this variable indicate slow walking speed and difficulty with activities of daily living. The negative relationship indicates that for an increase in difficulty with activity, OW is lowered. This is the expected direction of relationship and is significant within the model. The total effect or the sum of all causal (direct & indirect) and non-causal paths from health to OW is -0.322, comprised of the direct, indirect, and non-causal paths ( $p62$ ) + ( $p12 * p61$ ) + ( $p24 * p64$ ) + ( $p25 * p65$ ).

**4.6.1.3 Autonomy.** The beta coefficient for the direct effect of autonomy on OW within the model is not significant ( $\beta = 0.01$ ,  $p = 0.76$ ). The expected direction of relationship for this measure was negative, as a higher numeric score indicated that the individual frequently felt “unable to control important things” in life. This finding did not support the hypothesis for the model. The total effect of autonomy is also 0.01 as there are no indirect or non-causal paths specified in the model.

**4.6.1.4 Attitude.** The beta coefficient of the direct effect of attitude on OW is 0.32 ( $p < 0.01$ ). This significant positive relationship fits the expected direction of relationship in the model, with measures indicating positive attitude relating to higher OW scores. The total effect or the sum of all causal (direct & indirect) and non-causal paths from attitude to OW is 0.37, comprised of the direct, indirect, and non-causal paths ( $p64$ ) + ( $p24 * p62$ ) + ( $p24 * p12 * p61$ ) + ( $p24 * p25 * p65$ ).

**4.6.1.5 Relationships.** The beta coefficient for the direct effect of relationships on OW is 0.08 ( $P < 0.05$ ). This significant positive coefficient fits the expected direction of

relationship in the model with higher social contact frequency relating to higher scores of OW. The total effect or the sum of all causal (direct & indirect) and non-causal paths from relationships to OW is 0.11, comprised of the direct, indirect, and non-causal paths  $(p65) + (p25 * p62) + (p25 * p12 * p61) + (p25 * p24 * p64)$ .

#### 4.6.2 Indirect (Mediating) Effects. 2. Does Activity (M) mediate the effect of Attitude (X) on OW (Y)?

The procedure suggested by Baron & Kenney (1986) is summarized in Table 10.

Table 10  
*Activity – Attitude Mediation*

Procedure	Result	Interpretation
Step 1: Regress Attitude (X) on OW (Y)	OW = constant + (0.45**) Attitude R Square = 0.21	c = 0.45 ** Significance indicates there is a direct effect.
Step 2: Regress Attitude (X) on Activity (M)	Activity = constant + (-0.17**) Attitude R Square = 0.03	Significance indicates factors are correlated and mediation is possible.
Step 3: Regress Attitude (X) and Activity (M) on OW (Y)	OW = constant + (0.38 **) Attitude + (-0.31 **) Activity R Square = 0.28	The beta coefficient for activity is significant. c'=0.38** The effect of attitude is reduced by 0.07.
<i>Note.</i> * (p<0.05) ** (p<0.01)		

A partial mediation effect is present. The mediating factor of activity does reduce the effect of attitude on OW, however it does not reduce it to zero and the direct effect remains statistically significant.

#### 3. Does activity mediate the effect of relationships on OW?

A partial mediation effect is present (Table 11). The mediating factor of activity does reduce the effect of attitude on OW, however it does not reduce it to zero and the direct effect remains statistically significant.

Table 11

*Activity – Relationships Mediation*

<u>Procedure</u>	<u>Result</u>	<u>Interpretation</u>
Step 1: Relationships (X) on OW (Y)	OW = constant + (0.18**) Relationships R Square = 0.03	c = 0.18** Significance indicates there is a direct effect.
Step 2: Relationships (X) on Activity (M)	Activity = constant + (-0.13**) Relationships R Square = 0.02	Significance indicates factors are correlated and mediation is possible.
Step 3: Relationships (X) and Activity (M) on OW (Y)	OW = constant + (0.09**) Relationships + (-0.36 **) Activity R Square = 0.15	The beta coefficient for relationships is significant. c'=0.09** The effect of relationships is reduced by 0.09.
<i>Note.</i> * (p<0.05) ** (p<0.01)		

## 4. Does health mediate the effect of activity on OW?

Table 12 reports the Baron & Kenney (1986) procedure for this mediating effect.

Table 12

*Health-Activity Mediation*

<u>Procedure</u>	<u>Result</u>	<u>Interpretation</u>
Step 1: Activity (X) on OW (Y)	OW = constant + (-0.38**) Activity R Square = 0.14	c = 0.38** Significance indicates there is a direct effect.
Step 2: Activity (X) on Health (M)	Activity = constant + (0.25**) Health R Square = 0.06	Significance indicates factors are correlated and mediation is possible.
Step 3: Activity (X) and Health (M) on OW (Y)	OW = constant + (-0.28**) Activity + (-0.21**) Health R Square = 0.15	The beta coefficient for activity is significant. c'=-0.28** The effect of activity is reduced by 0.13.
<i>Note.</i> * (p<0.05) ** (p<0.01)		

A partial mediation effect is present. The mediating factor of health does reduce the effect of activity on OW, however it does not reduce it to zero and the direct effect remains statistically significant.

**4.6.3 Moderating Effect.** 5. Is age a moderating variable of the relationship between health and OW?  $OW = \text{constant} + b_1\text{health} + b_2\text{age} + b_3\text{age*health}$

Result:  $OW = 0.96 + (-0.57)\text{health} + (0.02)\text{age} + (0.28)\text{age*health}$

This regression model is significant overall ( $p < 0.01$ ) with the independent variables health, age, and age\*health accounting for 8.7% of variance in OW. Health is a significant predictor ( $p < 0.05$ ) in this model. The independent variables of age ( $p = 0.78$ ) and age\*health ( $p = 0.31$ ) are not significant predictors in the model.

Age is not a significant moderating variable of health's effect on OW in this model. The interaction term age\*health was created and tested for significance in the regression equation. The interaction term was not significant ( $p = 0.31$ ). Age in this model was significant at the  $p < 0.05$  level. Health was significant at the  $p < 0.01$  level.

#### 4.7 Overall Model Fit

As indicated in the diagram, all paths within the tested MTB model are significant with the exception of the direct effect of autonomy on OW. Autonomy when considered individually, does significantly negatively correlate with OW ( $r = -0.19$   $p < 0.01$ ), however in the context of the model it becomes insignificant. The sizable difference between the total effect size of autonomy in the path analysis (0.01) and the correlation ( $r = -0.19$ ) suggests that there may be unidentified paths linking autonomy to other factors within the model.

As detailed in Table 9, Attitude (0.36) has the greatest total causal effect on OW in this model. Activity (-0.32) has the second greatest causal effect, trailed by health (-0.26), relationships (0.11), and autonomy (0.01) in that order.

The match between the total effect of each variable and the respective correlation coefficients are close for the variable of health ( $r=-0.293/-0.28$ ), activity ( $r=-0.378/-0.322$ ) and relationships ( $r=0.178/0.11$ ). The unaccounted for approximately 0.01 in health, 0.05 in activity, and 0.06 in relationships is likely attributable to error. Attitude ( $r=0.454/0.365$ ) shows a difference of approximately 0.1, which may indicate an additional unidentified path in the model, or might be attributable to error. As previously mentioned, autonomy has a difference of 0.175 ( $r=-0.187/0.01$ ) which may indicate one or more hidden paths in the model.

#### **4.8 Results Summary**

The MTB model was partially supported by the NSHAP database. All direct and mediating paths hypothesized within the model were statistically significant ( $p<0.05$ ) with the exception of the direct path between autonomy and OW. The moderating effect of age between health and OW was not significant. Attitude and activity are the balance variables with the greatest total effect on OW in the model. There may be unidentified paths in the model including the variables of attitude and/or autonomy.

## **CHAPTER 5**

### **DISCUSSION**

#### **5.1 Path Analysis Findings**

Jacelon (2010) found that while participant's health problems varied, they engaged in self-management strategies to maintain balance between activity, attitude, autonomy, health and relationships. The older adult is organic and dynamic, adjusting the balance between the factors to achieve optimal wellness. The findings from this path analysis support the importance of attitude, activity, health and relationships on optimal wellness. However, in this investigation autonomy did not have a significant direct effect. Jacelon's finding that optimal wellness can exist at a high level, even in the presence of chronic disease conditions was supported by these findings. The paramount importance of a positive attitude in maintaining balance was also supported.

The path analysis findings partially supported the MTB model as hypothesized. Attitude had the largest direct effect on OW in the model, followed by activity and health. Relationships was also a significant predictor of OW, but at a lower level of significance and lower total effect size. Autonomy and age were found to be non-significant components of the model. It was surprising to this researcher that attitude and activity had larger total effects than health. When initially designing the study, I presumed that health would be the first most important factor, and the other factors would have lesser but important degrees of influence. The larger total effects of attitude and activity speak volumes for the importance of these factors in balancing chronic health problems for older adults. The potential modifiability of the factors of attitude and



activity also have a hopeful message for older adults who are already suffering from a high level of chronic disease. If the existing chronic diseases can't be modified, perhaps something within the factors of attitude or activity can be modified to increase OW overall.

**5.1.1 Attitude.** Positive attitude is well-documented in social science and health literature to have a significant association with health outcomes (Sabatini, 2014; Siahpush, Spittal, & Singh, 2008). The hypothesis for a significant positive direct effect between attitude and OW was supported by this path analysis investigation. Attitude was the factor with the greatest total effect size in the model (see Table 9). Attitude is more important than all other factors in maintaining balance. Jacelon (2010) cites one of her participants had a life out of balance that supports this finding. The participant had a very negative attitude about her situation and despite few health problems and unrestricted mobility she was not optimally well. This investigation supports the hypothesis that attitude is a very important factor in maintaining OW at home.

The hypothesis of a mediating path from attitude through activity en route to OW was suggested in the literature review by Beyer, Wolff, Warner, Schulz, and Wurm (2015) and Sabatini (2014). This “behavioral pathway” posits that happier people are more likely or more able to engage in healthful activities, which in turn impacts their health. This hypothesis was supported in the path analysis, with a significant partial mediation present.

**5.1.2 Activity.** Activity has the second greatest total effect on OW in this investigation. Difficulty with ADL tasks is correlated with poorer SRH across community-dwelling older adult populations (Idland, Smastuen, Engedal, & Bergland,

2014; Ng, Niti, Chiam, & Kua, 2006). In this investigation, the finding of a significant negative relationship between activity and OW supported the hypothesized direct effect and direction of relationship suggested by the literature review. The ability to get up and around and care for oneself (activity) has a significant impact on one's perceived health status.

The hypothesis of the mediating factor of health in activity's effect on OW also was supported in this investigation. The number of chronic disease conditions an individual suffers from was a partial mediating factor in the relationship between ADL difficulty and OW. Freedman, Martin, Schoeni & Cornman (2008) developed an explanatory model for activity limitations in later life. They suggest an alternate direction for this relationship, with activity limitation arising subsequent to health conditions and functional impairments, in combination with the effect of the environment. The design of this investigation does not allow for evaluation of the directionality of this relationship, so it is possible that this relationship may be reciprocal or contrary to the hypothesized model.

**5.1.3 Health.** Health had a significant negative direct effect on OW in this investigation. The variable of health was the total number of chronic diseases self-reported by an individual. Larger numbers of self-reported chronic diseases was associated with a lower OW score. This finding is consistent with other findings. For example, increased number of chronic diseases is consistently correlated with poorer SRH (Berglund, Lytsy & Westerling, 2014; Galenkemp, Braam, Huisman, & Deeg, 2013; Segerstrom, 2014). Latham and Peek (2013) took a longitudinal perspective on SRH and onset of morbidity and found that SRH was a significant predictor of the onset

of especially stroke and also any chronic condition excluding cancer. In their sample, an individuals' report of SRH at baseline predicted future diagnosis of nearly all chronic conditions. This finding draws into question the directionality of the relationship between Health and OW, and points to the reciprocal nature of this conceptual interaction. The limitations of path analysis technique did not allow for exploration of any potentially bi-directional relationships in this investigation, but future work may take this into consideration.

**5.1.4 Relationships.** Relationships were found to have a significant effect on OW in this investigation. An increase in social contact frequency (relationships) was associated with an increase in SRH (OW) measures, with a total effect of 0.11 (see Results). Social contact frequency does not consistently show a relationship to OW and is regarded as a poor indicator for OW (Hinerlong et al., 2007; Rozario et al., 2004 cited in Craigs, Twiddy, Parker & West, 2014; Nummela, Sulander, Karisto & Uutela, 2009). The secondary analysis

The effect of relationships on OW is partially mediated by activity. This finding is in congruence with Hawkley, Thisted, & Cacioppo (2009) who found a significantly reduced odds ratio of ability to participate in physical activity for people with higher loneliness scores.

**5.1.5 Autonomy.** Autonomy was found to have a non-significant direct effect on OW (total effect 0.01). The hypothesized direction of the relationship was negative due to the negative wording of the autonomy measure. The hypothesis of the presence of a direct effect was not supported, nor was the hypothesized direction of the relationship. This may be due to the measurement tool's inability to accurately capture the concept of

autonomy as described by Jacelon (2010), or may be due to the presence of an unspecified path or factor that was not identified in this model. The measure for autonomy was not robust within the NSHAP dataset. Autonomy was not a variable of interest in the original NSHAP investigation, and the measure chosen to act as a proxy for this variable does not fully capture the concept of autonomy. This was a significant limitation of the investigation that could not be modified due to the secondary analysis approach.

In the ‘original’ MTB theory, autonomy is described as both sustaining independence and exercising control (Jacelon, 2010). Autonomy is again described by Jacelon (2003) in a previous grounded theory investigation with hospitalized older adults as one of the properties of personal integrity. The construct of autonomy is comprised of the attributes of control and independence. The dual nature of autonomy was not well captured by the measure utilized here, as “I feel I am unable to control important things in life” addresses only the attribute of control, neglecting independence. In this specification of the model, independence may have been captured within the variable of activity where independence with I/ADLs was addressed. The incomplete measure of autonomy is a significant limitation and may be the reason that autonomy was not a significant predictor in the context of the path analysis.

I chose to leave autonomy in the final model, despite its non-significant direct effect on OW. While the calculated direct effect of autonomy is non-significant, it is my suspicion that it feeling in control of one’s life does in fact have a significant contribution to OW. One potential explanation for the difference between the correlation and total effect size in combination with the non-significant direct effect would be an unspecified

path in the model linking autonomy to activity. This path was not suggested in the literature, however in Jacelon's (2003) article being physically independent (being able to independently complete ADLs) was an important component of the concept of autonomy. An unspecified path linking autonomy to health is also theoretically suggested by Paterson (2001) who suggests that feelings of loss of control are what shift the focus from wellness in the foreground to illness in the foreground for elders coping with chronic disease. The significant theoretical support for the presence of autonomy within the model warrants further research prior to removing this important concept from the MTB model.

**5.1.6 Age.** The moderating effect of age on the relationship between health and OW was found to be non-significant in this model. This is likely due to the NSHAP sample, which did not include individuals over the age of 85. Previous literature suggesting this moderating effect (Galenkamp, Braam, Huisman & Deeg, 2011) suggested that the differences are seen in individuals over the age of 85. This was a limitation of this investigation due to the secondary analysis approach.

## **5.2 Relation to Existing Nursing Theory**

Wellness and balance are commonly used concepts in existing nursing theory. Neuman's systems model conceptualizes wellness as harmony among all client systems achieved through balance among stressors, resistances, and prevention (Fawcett, 2005). Parse's human becoming theory conceptualizes health and wellness as a changing process created in conjunction with personal commitment, the environment, and others (Parse, 1998 cited in McMahon & Fleury, 2012). Roger's science of unitary human

beings views health, wellness, and illness as values assigned in the context of society, culture, and time. In all three grand theory conceptualizations, the concepts of wellness and balance are linked and the role of the nurse is to assist the client to maintain balance and achieve wellness. In this way, the current investigation is congruent with these underpinning grand theories of nursing.

Existing mid-range nursing theories that include a conceptualization of wellness include Pender's health promotion model, Fleury's wellness motivation theory, and Miller's functional consequences theory (McMahon & Fleury, 2012). Pender's model includes the concepts of affect, similar to MTB attitude, "interpersonal influences," (relationships), and personal factors (health). The interaction of these factors to create a health-promoting behavior is conceptually similar to the MTB framework, however the outcome of interest is a behavior rather than wellness (OW) broadly. Fleury's theory similarly views wellness as a process of choice-making, with the nurse's role focused on helping individuals achieve their goals. Fleury's theory includes concepts of biological (health) and social resources (relationships). It does not however include a measure of attitude, which was the most important factor in this investigation of the MTB model (Perez & Fleury, 2009). Miller's functional consequences theory includes negative functional consequences (activity) as a central part of the model. In Miller's conceptualization, the nurse is assessing and intervening with age-related changes, negative functional consequences, and other risk factors as they play out to create positive functional outcomes (Miller, 1990). Each of the mid-range theories related to wellness includes one or more of the balance variables from this investigation. The MTB model stands unique in its combination of all five of the balance variables together to

explain OW for older adults. The concept of autonomy was the only balance variable not found in any of these existing mid-range theories and was also found to be non-significant in the MTB model.

Additional refinement, testing, and theoretical clarification is needed for the MTB theory before it can be used as a mid-range theory. The concept of autonomy warrants further investigation prior to elimination from the model.

### **5.3 Implications for Nursing Practice**

As a community-based nurse caring for older adults, I find evidence of the MTB model in my professional interactions with clients. I see daily that attitude has a profound effect on an individual's overall wellness, and that one's ability to get around and care for oneself (activity) also has a profound effect. The findings of this investigation suggest to me as a geriatric practitioner that interventions to support a positive attitude and to promote mobility and ADL independence should be paramount to practice in the community. The delicate balance among these variables is evidenced in the daily lives of my older adult clients. When an inevitable change in activity level, or a new health problem arises an older adult may draw on the power of their positive attitude or on a new or expanded helping relationships to compensate and maintain their current level of OW. The MTB model presents a holistic framework within which a nurse can understand the complexity of an older adult's concerns.

While this investigation may suggest a positive attitude is a cure-all, cultivating that positive attitude may not be a simple task. One existing study specific to individuals diagnosed with cancer points to the potentially troublesome nature of positive-attitude

promotion. The serious nature of many of the concerns experienced by older adults may make “just try to have a positive attitude” frustrating advice. In a qualitative descriptive investigation of what it means to have a positive attitude in the context of a cancer diagnosis, Wilkes, O’Baugh, and Luke (2003) spoke to 11 Australians with cancer. Their findings led to the following suggestions for nursing practice in the context of those with cancer diagnosis: first, to support the attitude a client is reporting; second, to not impose the belief that a positive attitude fights cancer; third, to allow for discussion of negative feelings; and fourth, to look deeper than a reported positive attitude to see what may be masked by it (p. 416). With this caution in mind, nursing intervention to support a positive attitude and activity level may be substantially helpful in promotion of OW.

Promoting ADL independence and supporting ADL deficits is an important role of the Community nurse. This may be accomplished through development of a supportive care plan and collaboration with primary care providers, community OT, PT, and ST providers, and delegation to home care aides. The importance of ADL independence and walking ability in this model suggest that nursing practice should include a focus on activity and independence. The MTB model may provide a community nurse with a framework for understanding the “big picture” of an older adults life in their home, with an emphasis on attitude and ADL ability as important factors for wellness promotion.

#### **5.4 Implications for Policy**

The Home Care Alliance of Massachusetts (HCA) states in a 2016 report that home is the desired site for care yielding high patient satisfaction, good outcomes, and cost-effective care. Supportive homecare services include short-term rehab focused PT,



OT, HHA, and Skilled Nursing services paid for by Medicare, long term supportive homemaker and personal care assistance services paid for by Medicaid, and ongoing Medicare-funded services for individuals who qualify for Palliative or Hospice care. There is a significant infrastructure/payment gap in the availability of personal care and homemaker assistance and nursing oversight for individuals who do not meet the very low-income limits for Medicaid qualification. For these individuals, the only available services are unregulated for-profit private-pay homecare agencies or hiring private individuals directly.

This investigation points to an understanding of the older adult at home in the community through a holistic lens, with attention to the many aspects of life that must be maintained in balance in order to achieve OW. Supportive homecare services are essential to supporting all aspects of an older adult's OW. The existing gap in payment infrastructure between short-term rehab services and palliative or hospice care neglects an important opportunity for wellness promotion. The results of this investigation point to the importance of supporting an older adult's attitude and activity level. Homecare aides under the supervision of a community nurse are well-positioned to support or enhance the ADL independence and walking ability (activity) of an older adult. They are also a source of social contact (relationships). Being in the home environment is supportive of positive attitude because this is the desired site of care for most older adults.

### **5.5 Study Limitations and Validity**

Significant limitations exist within this investigation. All discussions of findings consider the limitations related to the secondary analysis approach, assumptions

violations, and lack of evidence for causation.

Testing of the theoretical and statistical assumptions reveals several limitations, particularly in the normality of the outcome variables for the regression models used to test the mediating effects of activity and health. Caution was exercised when interpreting these results.

The secondary analysis approach has also been addressed as a limitation. Measurement errors inherent in the dataset may be present, and were not able to be controlled for. As discussed in section 5.1.5, the measure of autonomy was incomplete in this investigation, and may have overlapped conceptually with the measures used for activity. Use of data collection instruments chosen to specifically capture the concepts of interest would have enhanced this investigation. Sampling of individuals over the age of 85 may also have increased the generalizability of these findings to older-old individuals and may have led to the ability to detect a moderating effect of age between health and OW. There may also be additional confounding variables present that have not been included in the MTB model.

Due to the cross-sectional nature of this analysis, causation cannot be determined. Therefore, the directional arrows in the path analysis findings may not truly represent an understanding of causation. For example, the strong positive association between attitude and OW may be bi-directional or actually have a causal effect in the opposite direction. Perhaps being optimally well actually creates the condition of happiness and positive attitude that older adults reported in this investigation.

## **5.6 Suggestions for Future Research**

An unidentified mediating path connecting activity and autonomy is suggested both by the statistical results from this investigation and, in retrospect, by Jacelon (2010). Theoretical overlap between the concepts of activity and autonomy and the available operational definitions in the dataset may be to blame for the insignificant direct effect between autonomy and OW. This mediating path could be tested in future studies.

Refinement of the MTB model in the context of existing theory would be beneficial for future research. Exploration of the concept of autonomy in nursing and psychological literature is warranted prior to elimination of autonomy from the MTB model. Additional investigation into hidden paths within the model and hidden factors that may not have been considered in this initial conceptualization of the model is also a direction for future investigation. Utilizing longitudinal data would allow for causal conclusions and be beneficial in determining the directionality of the conceptual relationships.

The sizable significant relationships between attitude and activity and OW in this investigation point to the importance of these concepts in the life of community dwelling elders. Further research could investigate appropriate nursing assessment and intervention for supporting these factors in the home environment.

## **5.7 Conclusion**

By 2020, it is projected that 1 in 5 people living in the United States will be over the age of 65. This demographic shift will necessitate changes in policy and infrastructure

for support of older adults in their preferred site for care – their own homes. The MTB model addresses the older adult in a holistic manner, seeking to understand the fundamentals of successful community-based living. The purpose of this investigation was a quantitative investigation of a qualitatively-derived theory and determine the fit of that theory to the NSHAP database.

Findings from this investigation support the MTB model. The variables of attitude, activity, health, and relationships have significant association with the outcome of OW. Autonomy and age were non-significant factors in this investigation. The MTB model shows promise for further refinement as a mid-range nursing theory, and as a theoretical framework to drive community-based nursing practice.

**APPENDIX A:**  
**IRB MEMORANDUM**



**University of Massachusetts Amherst**  
108 Research Administration Building  
70 Butterfield Terrace  
Amherst, MA 01003-9242

**Human Research Protection Office  
Research Affairs**

**Telephone:** 545-3428  
**FAX:** 577-1728

**MEMORANDUM**

**To:** Sheila Pennell, Nursing  
**From:** Human Research Protection Office  
**Date:** February 9, 2016

**Project Title:** **Exploring the Balance: A Path Analysis Examination of the Maintaining the Balance Model**

**IRB Number:** 16-14

The Human Research Protection Office (HRPO) has evaluated the above named project and has made the following determination:

- ☐ The activity does not involve research that obtains information about living individuals.
- ☐ The activity does not involve intervention or interaction with individuals OR does not use identifiable private information.
- ☒ The activity is not considered research under the human subject regulations. (Research is defined as "a systematic investigation designed to develop or contribute to generalizable knowledge.")
- ☐ The activity is determined to meet the definition of human subject research under federal regulations and requires submission of applicable materials for IRB review.

For activities requiring review, please see our web pages for more on [types of review](#) or [submitting a new protocol](#). For assistance do not hesitate to contact the Human Research Protection Office at 545-3428 for assistance.

**APPENDIX B:**  
**REQUEST FOR NSHAP DATA**

Sheila Pennell PhDc, RN

3 Pleasant St.

South Hadley, MA 01075

Director, National Archive of Computerized Data on Aging Inter-university Consortium  
for Political and Social Research Institute for Social Research

P.O. Box 1248

University of Michigan Ann Arbor, MI 48106-1248

TO THE ATTENTION OF NSHAP PROJECT DIRECTOR

Dear Dr. O'Doherty or current director,

Principle investigator Sheila Pennell seeks permission to use the Wave 1 data of the NSHAP database for a secondary analysis of data that will serve as a doctoral dissertation at the College of Nursing, UMass Amherst. The title of this investigation is *Exploring the Balance: A Path Analysis of the Maintaining the Balance Model*. Please be assured that the data will be kept securely in accordance with the restricted use agreement as described below:

A single MacBook Pro will be the primary computing environment for data analysis. A secure removable USB storage drive will be the location for data storage. The computer stands alone for personal use with no networked connections. The computer is stored in a locked private home with no public access and is password protected. The

removable storage holding the data will be kept in a locked home safe when not in use. The Mac program FileVault will be used to create 128 encryption on the removable drive. No backup copies will be made. No electronic transmittal of data will be conducted. The PI will share physical access to the removable storage containing the data with academic advisors for purposes limited to academic advisement on data analysis process. The PI will ensure that no copies are made of the data. Physical printouts (if made) of raw data information will be stored securely in locked home safe until they are no longer needed and can be shredded.

The data will be analyzed using SPSS for the purpose of path analysis of a proposed model. When the investigation is complete, the data will be permanently deleted from the encrypted removable disk. Any future use of the data will seek additional permission for the download as per the restricted use agreement.

Thank you for considering my request,

Sincerely,

Sheila Pennell  
University of Massachusetts, Amherst  
Mailing Address:  
3 Pleasant St. South Hadley MA 01075  
[Pennell.sheila@gmail.com](mailto:Pennell.sheila@gmail.com) (413) 244-2111

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